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# REPORT

ON THE

# ABOLITION OF GRADE CROSSINGS

IN THE

# CITY OF WORCESTER,

BY

RR

CHARLES A. ALLEN,
AUGUSTUS W. LOCKE,
JOHN W. ELLIS,
*Commissioners.*

Worcester, Mass.:
PRESS OF F. S. BLANCHARD & CO.,
154 FRONT STREET.
1892.

# CORRECTIONS.

Page 30, 19th and 21st lines read *is* instead of [illegible]

Page 37, 30th line, read *2,509,496.00* instead of [illegible]*6.00*

Page 47, 2nd line, read *should* after *subject*.

Page 50, 1st line, read *Thomas* after *Central*.

Page 65, 33rd line, read *850* instead of *1200*.

Page 66, 10th line, read *200* instead of *100*.

Page 58, 3rd line, read *3* feet instead of *2* feet.

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# CITY OF WORCESTER.

*To His Honor the Mayor, and the Board of Aldermen.*

The undersigned were appointed by you under the following order.

"City of Worcester.

In Board of Aldermen, Dec. 8th, 1890.

*Ordered:* That a Commission consisting of the City Engineer and two other expert engineers who shall be named by the Mayor, be appointed to examine all grade crossings in the City, make plans of the same as they now are, together with plans of proposed changes, and report to this Board the most beneficial way to the City. to have said grade crossings abolished. The expense for the same shall be charged to street construction.

Approved December 23d, 1890.

(Signed) FRANCIS A. HARRINGTON,
*Mayor.*"

As soon as practicable we met at the City Hall and advertised a public hearing to be held in the Council Chamber on March 14, 1891. This hearing was attended by citizens, who expressed their views freely, and suggested for our consideration several methods by which the desired object might be attained.

The opinion was unanimous that the grade crossings of the City of Worcester were a source of great danger and inconvenience to the inhabitants, and that the time had come for their abolition.

The methods which were suggested were as follows:

First. To remove the railroads with their stations and sidings out of the thickly settled parts of the City.

SECOND. To depress the railroads sufficiently to carry the streets over them at their present grades.

THIRD. To raise the Southern railroads (the Boston & Albany, the New York & New England, and the New York, Providence & Boston), and the tracks in the Union Station, and extend the tracks of the Northern railroads (the Fitchburg and the Boston & Maine) in a tunnel through Laurel Hill to a junction of the Boston & Albany Railroad east of the Union Station.

FOURTH. To depress the railroads, including the tracks in the Union Station, and raise the streets sufficiently to carry them over the tracks.

FIFTH. To elevate the railroads and depress the streets.

Before considering in detail the various plans outlined above, we desire to call your attention to the condition of things previous to 1871, when the Union Passenger Station Act was passed by the Legislature, also to point out the various changes and improvements which have taken place since.

The city seems to have passed through two periods in its history of transportation since the time when it was a village and horse power its only reliance.

The old arrangement with the passenger stations at Washington Square, Foster Street, Green Street, Lincoln Square and South Worcester grew up gradually from 1835, the year of the entrance of the Boston & Worcester Railroad into the city to the year 1871.

Previous to 1871 all of the railroads entering the city crossed nearly every street at grade, there having been no changes in this respect from the time the roads were constructed.

The Worcester & Nashua (now Boston & Maine) Railroad, the Norwich & Worcester (now New York & New England), and the Boston & Worcester (now Boston & Albany) had their stations at Foster Street.

The Western Railroad (now Boston & Albany) had its station at Washington Square, while the Worcester & Nashua Railroad had a way station at Lincoln Square, as at present.

The South Worcester station was also used by all the roads as a way station.

The tracks of the Worcester & Nashua Railroad crossed al lof the streets, with the exception of Union Street, between the Foster Street station and Lincoln Square at grade, as at present.

The tracks of the Norwich & Worcester Railroad crossed Mechanic, Front, Park, Myrtle, Southbridge and Madison Streets at grade, while the track of the Boston & Worcester Railroad crossed Summer and Shrewsbury Streets at grade in about the location of the present Boston & Maine tracks. In fact all but six of the crossings in the city were at grade.

In May, 1871, the Union Station Act was approved by the Governor, and became a law. This Act provided that a Union Station should be constructed on the northerly side of the main tracks of the Boston & Albany Company, between Green Street and Grafton Street, or at a point east of Grafton Street, and not more than 1500 feet distant therefrom. It also provided that the Boston & Albany Railroad Company should erect and maintain the station, and that the other railroad companies using the station should pay a suitable rent for their accommodations.

The Act also provided that the Norwich & Worcester Railroad between the Foster Street station and the south line of Park Street, and the Worcester & Nashua Railroad between the easterly line of Union Street and the southerly line of Park Street should be discontinued, and the tracks were accordingly removed, together with the Foster Street station, thus abolishing three extremely dangerous grade crossings at Mechanic, Front and Park Streets.

The Act also provided that the Boston & Albany Railroad should be discontinued between the south line of Shrewsbury Street and the Foster Street station. But by this portion of the Act no grade crossings were abolished, as the location of the Boston & Albany Railroad at Shrewsbury and Summer Streets was immediately taken possession of by the Worcester & Nashua and Boston, Barre & Gardner Railroads.

The Act provided that after the abandonment of the Foster Street station, the Norwich & Worcester Railroad Company should extend its tracks from the Junction station to the Union

Station; and the Providence & Worcester Railroad Company should extend its tracks from its passenger station at Green Street to the Union Station.

By carrying out this latter provision of the Act, the number of grade crossings was not increased, but the amount of railroad traffic upon the crossings between the Union Station and the Junction Station was very materially increased.

The Worcester & Nashua Railroad Company were directed to locate their passenger tracks so as to enter the Union Station upon its northerly side.

The Boston, Barre & Gardner Railroad was directed to extend its track from its terminus north of Garden Street to the Union Station, running upon the easterly side of and parallel to the Worcester & Nashua Railroad. This increased materially the amount of traffic on all of the grade crossings between Lincoln Square and the Union Station.

To take the place of the exchange freight tracks between the Northern and Southern roads, which previous to the passage of the Act were located between Union Street and Park Street on substantially the location of the Worcester & Nashua, and the Norwich & Worcester Railroads, it was ordered that the Northern and Southern roads should join in the location and construction of a viaduct, which was to pass over Bridge, Mechanic and Front Streets by suitable bridges.

The Act provided further under Section 17, as follows:

"For the purposes aforesaid, said Corporations respectively may make any changes in the grade and construction of their railroads and with the consent of the Mayor and Aldermen of said city may raise, lower, alter the course of, or otherwise change any streets or ways in said city."

If the railroads and the city had availed themselves of the permission given them by this section of the act, this whole matter of grade crossings could have been settled at that time and in a very much more satisfactory manner, and at very much less expense than is possible at present.

The work of constructing the Union Station and bringing all the railroads into it was completed in 1875.

In 1884 another Act was passed by the Legislature, in consequence of a petition therefor by the city authorities, providing that the Norwich & Worcester Railroad Company should remove its freight station and all its tracks to land south of Madison Street. This work was carried out and four grade crossings at Burnside Court, Myrtle, Southbridge and Madison Streets, then almost constantly occupied by switching engines and cars, and by far the most dangerous crossings in the city at the time, were abolished.

Subsequently the two dangerous crossings of Cambridge Street across the Providence & Worcester Railroad, and Franklin Street across the Boston & Albany, Providence & Worcester, and Norwich & Worcester Railroads were abolished, the former in 1883, and the latter in 1887-88, and on the Boston & Albany Railroad, Sutton Lane, Webster Street, Heard Street and Ludlow Street have been either abolished the past year or are now under construction.

In the year 1887, after the Boston, Barre & Gardner Railroad had become a part of the Fitchburg, the present Fitchburg local freight yard and house were established between Blackstone and Summer Streets.

No material change has taken place in the yards of the other railroads since.

From the above statement it will be seen that from the date of the introduction of railroads into the city until the present day there has been a total of thirteen grade crossings abolished; six of them by raising or lowering the streets, and seven by removing the tracks.

We will now proceed to consider the five different methods proposed.

## FIRST METHOD.

To remove the railroads with their stations and sidings out of the thickly settled portions of the city.

This plan involves very radical changes, and the abandonment or destruction of all the present facilities for doing business dependent upon convenient railroad accommodations. Nearly all of the large manufacturing interests of the city are now dependent upon direct railroad accommodations for the economical transaction of their business.

In nearly every instance where heavy manufacturing is done, a side track from one of the railroads is run either into the yard or into the building itself, so that raw material is delivered at the works without carting, and the manufactured article is loaded directly upon the cars, thus saving a very considerable expense in handling.

Whatever changes may be made will affect these accommodations to a greater or less extent, and we are decidedly of the opinion that the plan to be adopted should be one that involves as little change in this direction as possible.

We also desire to call your attention to the fact that the larger part of the retail trade and the lighter manufactures are within easy distance from the freight yards, and that any plan involving radical changes in the location of freight yards will be a matter of quite serious inconvenience to a very large portion of the business interests of the city.

## SECOND METHOD.

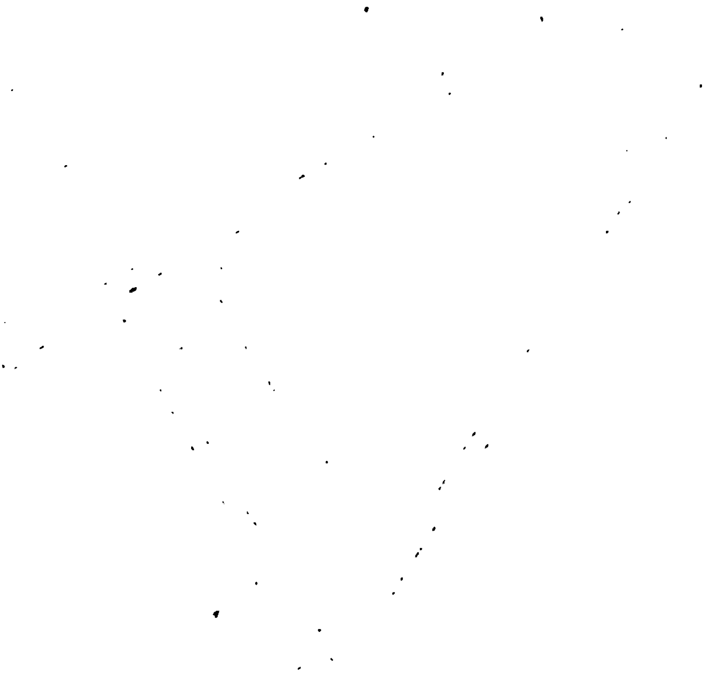
To depress the railroads so that the streets will pass over them without change of grade.

[illegible] plan would involve the sinking of the railroads not less than 20 feet throughout the whole city, and is impracticable owing to the fact that proper drainage cannot be obtained. The main sewer, which runs north and south through the entire length of the city, and which now passes under the railroads at various points, cannot be lowered sufficiently to afford proper drainage, and furthermore, if the main tracks should be depressed as above, the various side tracks leading to the manufactories would have to be abandoned.

## THIRD METHOD.

To raise the Southern railroads, (the Boston & Albany, the New York & New England, and the New York, Providence & Boston) and the tracks in the Union Station, and extend the tracks of the Northern railroads, (the Fitchburg and the Boston & Maine) in a tunnel through Laurel Hill to a junction with the Boston & Albany east of the Union Station.

This plan involves the abandonment of all the tracks between



Lincoln Square and the Union Station; and as there are large manufacturing industries which depend upon direct railroad communication for the economical transaction of their business, it seems to us a matter of very doubtful expediency, as we have already stated, to make such radical changes. In addition to this, the entire length of track through the tunnel between a point north of the Boston & Maine freight house, and the south end of the tunnel would be inaccessible for business purposes. Besides this, there is the excessive cost of the plan, which, for the tunnel alone, if built for two tracks, will be $1,200,000.

## FOURTH METHOD.

To depress the railroads, including the tracks in the Union Station, and raise the streets sufficiently to carry them over the tracks.

By this we understand it is meant to depress the tracks to as great an extent as it can be done and obtain proper drainage. The balance of head-room required by law between the rails and the under side of the street bridges, (namely, 18 feet) is to be made up by raising the streets. This plan also involves very great changes in the Union Station and in Washington Square.

### THE BOSTON & MAINE AND FITCHBURG RAILROADS.

In considering this question of depressing the railroads so that the streets may pass over them, it will be seen that the question of drainage is a most important one.

The depth to which the tracks can be lowered is governed entirely, so far as drainage is concerned, by the elevation of the Mill Brook sewer, the main channel of the entire sewerage system of the city.

This channel is arched and extends through the city from north to south, and nearly through the centre of the more densely populated portion of it. It crosses the Boston & Albany, New York & New England, and New York, Providence & Boston Railroads, at a point 619 feet westerly of the Union Station, and after passing under the Viaduct, runs in Blackstone and Union Streets, on a line nearly parallel to the northern railroads, to Lincoln Square, and from thence northerly in Prescott Street and through the Boston & Maine Railroad yard and the Washburn & Moen Mfg. Co's yard to Salisbury pond. The grade of the sewer where it crosses the southern and western roads can be lowered from Green Street, where there is a fall of eight feet, northerly to the railroad location, a distance of 2306 feet, but as this could only be done at great cost, probably not less than $150,000, we are of the opinion that it would not be advisable to attempt it, especially as the tracks can be lowered under existing conditions at least 13.5 feet.

The only point north of the Boston & Albany Railroad where the sewer grade can be lowered is in Union Street, at the building formerly occupied by the Vaill Chair Company; at this point there is a fall of about 8 feet, which has been utilized by Mr. Salisbury, the owner of the building, for power purposes.

As the present grade of the sewer north of this point and at Lincoln Square is such, that the top of the arch is within 5 feet of the street grade, and unless changes are made in the sewer the tracks can be lowered but 4 feet, it will be necessary to lower the sewer and the railroad tracks a corresponding amount, if this plan should be adopted.

By changing the grade of the sewer 8 feet and constructing it upon a grade parallel to its present grade, the tracks can be lowered 13.0 feet, while the grade of the Square would be raised at the railroad but 7.0 feet.

It would undoubtedly be best to construct this new sewer so that it could be used in connection with the project to separate the water flowing in Mill Brook from the sewage of the city, for the purpose of more readily treating the sewage at the sewage disposal works at Quinsigamond.

A structure could be constructed in Prescott Street from Lincoln Square to the point where Mill Brook crosses the street at the Washburn & Moen Works, which could be used for both purposes. It seems to us that in any event, the sewer should be laid in this street, and the brook turned into it whenever the demands are such that the city will feel obliged to put it under cover; we therefore shall include but a portion of its cost in the account of grade crossings.

It would also be of great advantage to the city to have the structure in a public street rather than in private property, as would be the case if the present channel were arched.

| | |
|---|---|
| Cost of new structure from Vaill's factory in Union Street to the point where Mill Brook crosses Prescott Street, | $151,500.00 |
| From this deduct the cost of the sewer if it were laid in Prescott Street at its present grade, as should be done in any event, | $71,700.00 |
| Amount that should be properly charged to grade crossing account, | $79,800.00 |

It will also be necessary to lower the lateral sewers that connect with the Mill Brook sewer in Lincoln Square, Market Street and School Street, as they are at present at too high a grade to pass under the tracks if lowered.

Between the Boston & Albany Railroad and Vaill's factory, as the top of the arch of the Mill Brook sewer is but a few feet below the grade of the tracks of the northern railroads, especially between Exchange and Market Streets, they can be lowered but little.

By the plan under consideration, the track at the Union Station can be lowered 12.0 feet. From this point it would have a level grade to Thomas Street. It would then rise slightly to Lincoln Square, the entire rise in this distance being only two feet. From this point northerly the track of the Boston & Maine Railroad would rise at a grade of 51.4 feet per mile to a point 1200 feet north of Garden Street, where the present grade of the tracks would be reached.

Between Lincoln Square and the entrance to the Boston & Maine freight station, the Fitchburg Railroad track would rise, the rate of grade being 66.79 feet per mile. This is necessary in order to obtain an approach to the freight station that can be used.

From this point to Garden Street the grade would be 34.98 feet per mile, and from Garden Street north it would be the same as that on the Boston & Maine Railroad described above.

The following table shows the amount that the track would be lowered, and the streets raised by the plan under consideration:

| | | Railroad Lowered. | Street Raised. | |
|---|---|---|---|---|
| Shrewsbury | St. | 12.6 ft. | 7.4 ft. | |
| Summer | “ | 12.1 “ | 7.9 “ | |
| Bridge | “ | 14.5 “ | 21.0 “ | St. now passes under tracks. |
| Exchange | “ | 4.5 “ | 15.5 “ | |
| Central | “ | 3.7 “ | 16.3 “ | |
| Thomas | “ | 3.7 “ | 16.3 “ | |
| School | “ | 5.7 “ | 14.3 “ | |
| Market | “ | 7.4 “ | 12.6 “ | |
| Lincoln Sq. | “ | 13.0 “ | 7.0 “ | |
| Garden St. | “ | 3.6 “ | 16.4 “ | |

All streets north of Garden Street will be considered isolated crossings and will be dealt with separately.

The greatest amount that the railroad is lowered is between Bridge Street and the Union Station, except at Lincoln Square. This is due to the fact that the present grade of the road is lowest between Central and Thomas Streets, and rises rapidly in each direction until Lincoln Square is reached on the north, and the Union Station on the south, while the proposed grade is practically level between these points.

Let us now consider how the property in the immediate vicinity of the railroads will be affected, beginning at Shrewsbury Street.

By consulting the table it will be seen that in order to obtain eighteen feet in clear height between the rails and the under side of the street bridge, (as required by law), the street would have to be raised 7.4 feet and the track lowered 12.6 feet. The grade of the street, as planned, would be 3 per cent., falling from the bridge easterly, intersecting the present street grade at a point 140 ft. east of the center of Mulberry Street, or nearly opposite the east end of Smith & Green's block ; the fill in front of Mulberry Street would be 5 feet, so that a change would be necessary in said street, extending from Shrewsbury Street north, about 150 feet.

On the Washington Square side of the tracks, the street grade would be 5.2 per cent.

SUMMER STREET would be raised 7.9 feet and the railroad lowered 12.1 ft. The change in the grade of the street upon the north side would begin at Fulton Street, the grade rising at the rate of 3 per cent. to the crossing. On the Washington Square side the grade would descend at the rate of 4.6 per cent., the filling in front of Bowker's new block and the United States Hotel being about 6 feet.

The BRIDGE STREET CROSSING is more difficult to adjust, owing to the fact that the street now passes under the railroad. The grades of the street and the railroad change places. As all the property adjacent to this crossing has been developed to conform to the present street grade, the damages would be very great.

The filling at the bridge would be 21 feet. The grade upon the south side would be 4 per cent., falling from the bridge, and joining the present grade of the street at a point 60 feet south of Mechanic Street.

This would necessitate a raise at Foster Street of 11 feet and at Mechanic Street of 4 feet. The filling in front of J. M. Bassett's shop between Foster and Manchester Streets would be about seventeen feet, while the grade of Manchester Street would have to be changed for almost its entire length, if allowed to enter Bridge Street as now located. The damages would be very much less, and the accommodation to public travel would be preserved, if the easterly end of Manchester Street could be re-located, by turning it into Foster Street between Bassett's building and Frank Wesson's pistol shop, there being sufficient unoccupied land in this place for the purpose.

That portion of Manchester Street between the new location and its intersection with Bridge Street can remain open, without a connection with Bridge Street, the new grade of Bridge Street being maintained by a retaining wall.

On the northerly side of the railroad the grade would descend to Summer Street, the fall being 3.3 per cent. It would be necessary to construct a trestle of iron passing the Fitchburg freight house and the cold storage building of Genery Stevens. This would allow the track into the storage building to be maintained, lessening the damages to a considerable extent. For the remaining distance to Summer Street, a solid embankment with retaining walls upon the street lines would be necessary. As this would destroy the approach to the freight house, a 30 foot driveway would have to be provided from Summer Street to the freight house adjacent to and northerly of Bridge Street, and to follow the present grade of the street. This would be a sufficient outlet from the freight yard at its easterly end.

BLACKSTONE STREET would be abandoned from Bridge Street to a point north of Charles Street, in order to avoid the grade crossing leading to the Fitchburg freight station.

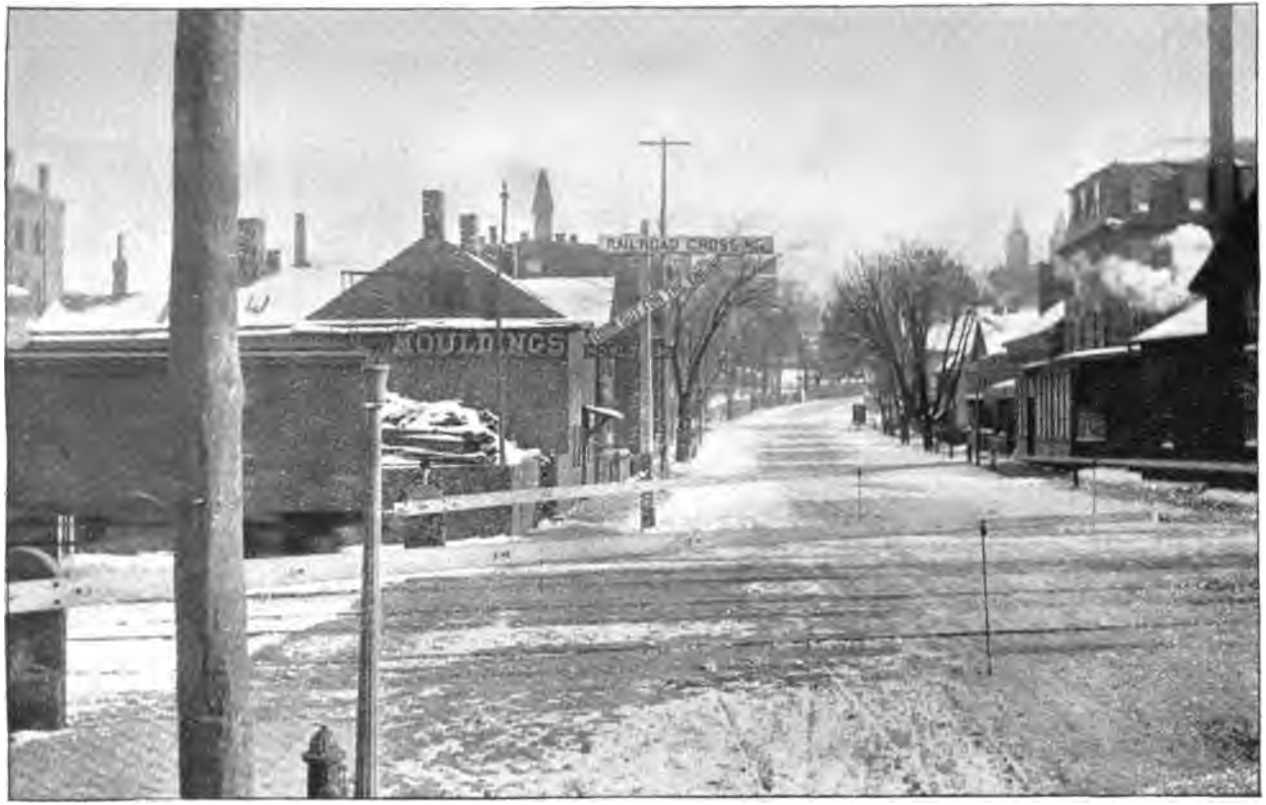
At Charles Street a small area of land would have to be taken from the estate upon the northwest corner of the street, in order to provide room for the street to pass north of the Fitchburg freight tracks. From this point Blackstone Street would rise to the new grade of Exchange Street, the grade being 5.6 per cent.

The filling in front of Robbins' planing mill would be about 11 feet. A retaining wall would have to be constructed upon the westerly side of the street to protect the railroad tracks.

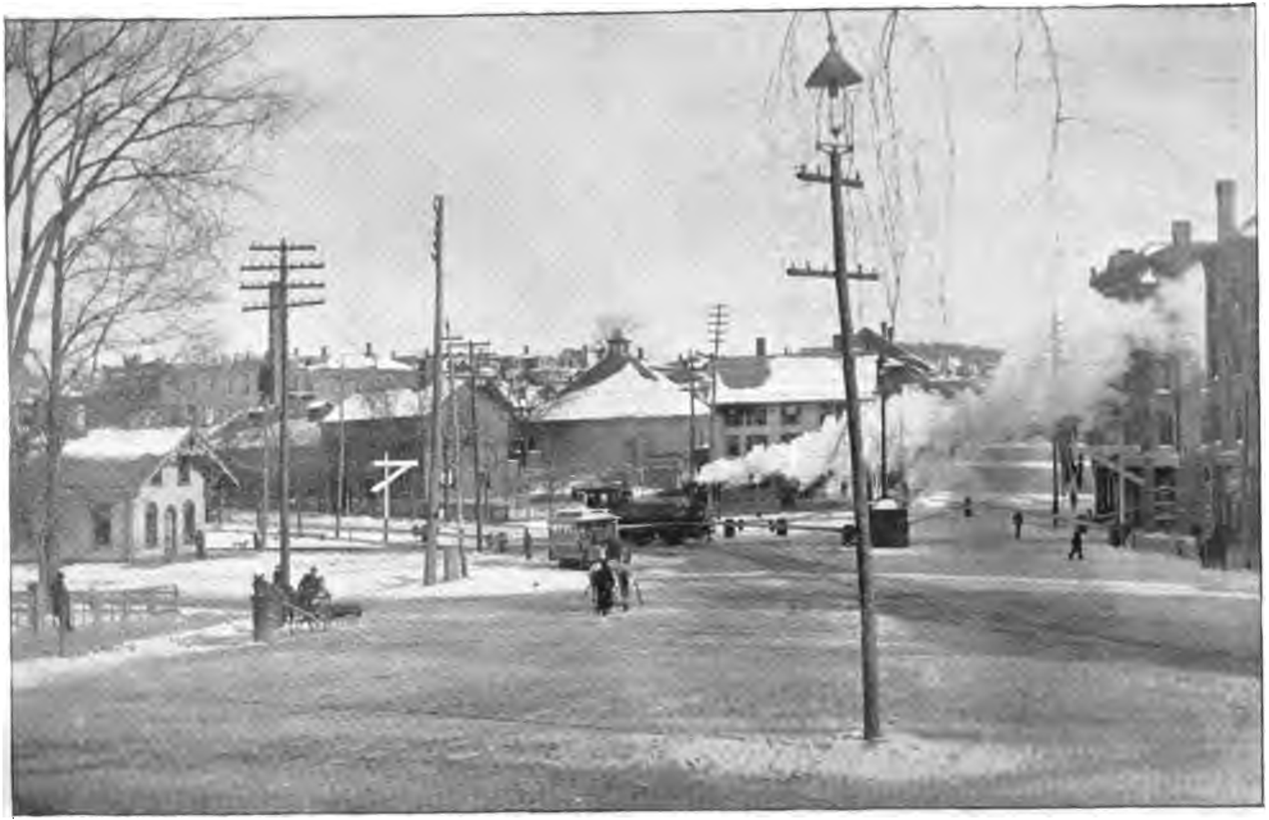
EXCHANGE STREET would be raised 15.5 feet and the tracks lowered 4.5 feet. The grade of the street upon the easterly side of the railroad would be 5 per cent., falling towards Summer Street, and would join the present street grade at a point 120 feet westerly of Summer Street. The fill in front of Thomas Kenny's brick buildings would be 10 feet. Upon the westerly side of the tracks the grade of the street would descend 5 per cent. from the railroad, joining the present grade at a point about 100 feet west of Union Street. The street at the centre of the brick building between the railroad and Union Street would be raised 12 feet, while Union Street would be raised 6.5 feet.

CENTRAL STREET would be raised 16.3 feet and the railroad depressed 3.7 feet.

Upon the easterly side of the track the street grade would join the present grade at Summer Street, the fall being 2.7 per cent. The depth of filling one half way between the railroad and Summer Street would be 12 feet. On the westerly side of the tracks the grade would fall at the rate of 3.5 per cent., the filling at Union Street being 12 feet. It would be necessary to provide a trestle in front of the Holyoke Machine Company's shop, and over the spur track leading from the railroad to the company's yard. At all other points solid embankment and retaining walls would be required. This spur track can be



Central Street Crossing, looking east.
WORCESTER.



Lincoln Square Crossing, looking east.

lowered 2 feet. In front of the Holyoke Machine Company's works the trestle would be 14.0 feet above the present street grade, and in front of Keyes' Planing Mill the street would be raised 10 feet.

THOMAS STREET would be raised 16.3 feet and the railroad lowered 3.7 feet. The grade of the street on the easterly side of the tracks would descend from the railroad, the grade being 2.7 per cent., joining the present grade at Summer Street. The depth of filling one-half way between the railroad and Summer Street would be 8 feet. On the westerly side of the tracks the street would descend, the grade being 2.5 per cent. A trestle covering the whole width of the street would be provided between Union Street and the railroad. This would diminish the damages to the Holyoke Machine Company's estate, and would allow the spur track used by the company to cross the street below grade. The filling at Union Street would be about 12.0 feet. In front of the Machine Company's building the trestle would be about 14.5 feet high.

SCHOOL STREET would be raised 14.3 feet and the railroad lowered 5.7 feet. The grade of the street would descend from the railroad upon the easterly side, it being 2 per cent. A solid embankment with retaining walls would be provided. Upon the westerly side of the railroad the grade of the street would descend, the grade being 5 per cent. This would also be constructed with retaining walls and earth filling. The depth of filling in front of Garfield & Harrington's stable yard would be 11 feet. In front of Lombard's machine shop the street would be raised 10 feet, at Union Street 7.5 feet.

MARKET STREET would be raised 12.6 feet, and the railroad lowered 7.4 feet. The street would rise from the railroad to Summer Street, the grade being 1.7 per cent. Upon the westerly side it would fall from the railroad to a point about 120 feet west of Union Street, the grade being 5 per cent. The fill at Union Street would be about 8 feet. Upon the easterly side of the railroad at a point one-half way between the railroad and Summer Street the fill would be about 8.5 feet. The street would be constructed with side walls and earth filling.

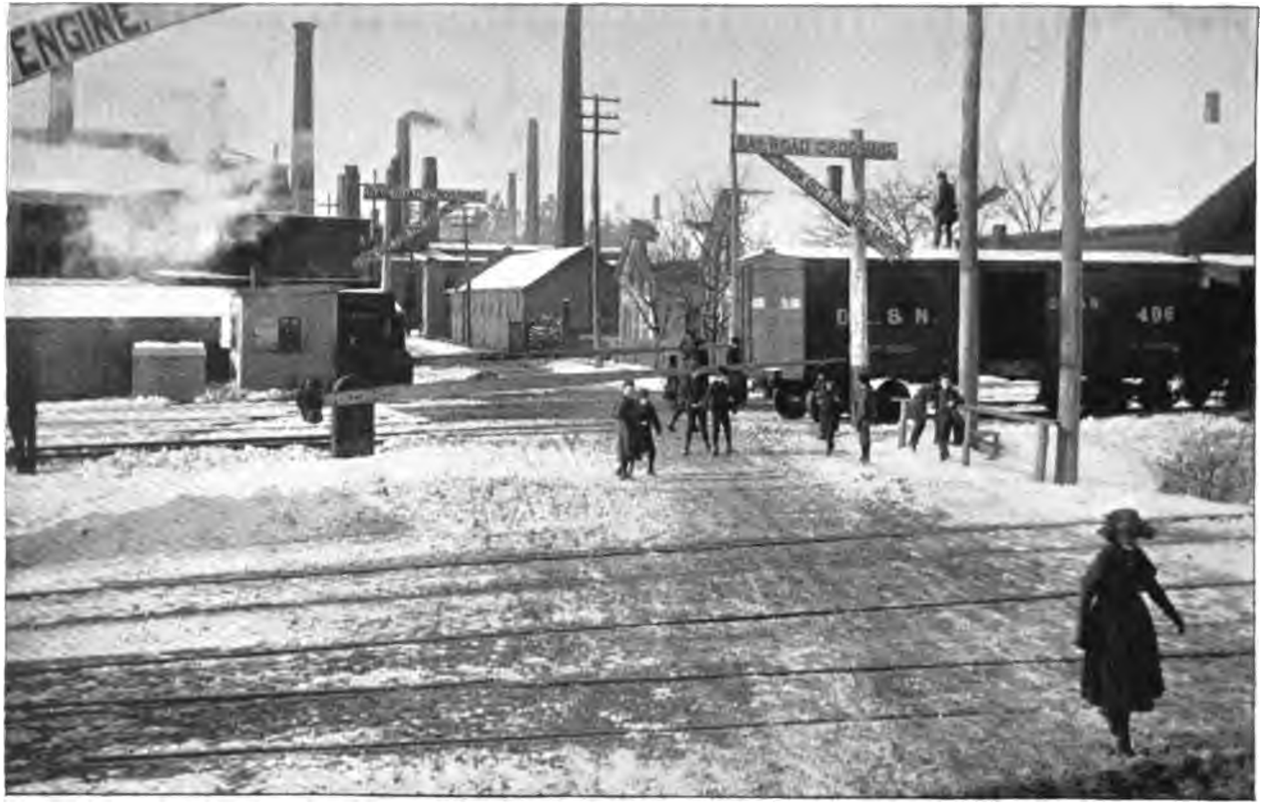
LINCOLN SQUARE: We have previously shown, that in order to depress the railroad tracks sufficiently to allow the

Square to pass over them, without creating excessive damages to adjoining property, it would be necessary to lower the Mill Brook sewer from the Vaill factory, northerly, and that by so doing the railroad tracks could be depressed 13.0 feet, while the grade of the Square would be raised but 7.0 feet. If this suggestion were carried out, the grade of the Square upon the easterly side of the railroad from the bridge to Belmont Street would be level, the present grade being intersected at a point a few feet east of Summer Street. Summer Street would be filled about 3 feet at its intersection with the Square, and would have a grade of 2 per cent., falling from the Square. Lincoln Street would have a level grade from Linwood Place to the railroad.

Upon the Main Street side of the tracks the street would descend from the railroad, the grade being 2.5 per cent., the filling in front of Prescott and Union Streets being about 4 feet. Salisbury, Highland and Main Streets would remain unchanged. The filling in front of the Salisbury Building, between Union Street and the railroad would be about 5 feet, and the same in front of the building located between the railroad and Summer Street. By the plan under consideration Union Street would be raised for a distance of 1700 feet, the depth of filling being about 10 feet.

The only remaining street affected by this plan is Garden Street. Here the tracks would be lowered only 3.6 feet, while the street would be raised 16.4 feet. As the Fitchburg and the Boston & Maine Railroads are some little distance apart at this crossing, we have provided for carrying the streets over the railroads on an iron trestle. This would also extend over the spur track leading to the Washburn & Moen Manufacturing Company's works, and would be about 275 feet long. Aside from this, earth filling with retaining walls wherever necessary would be used. The grade of the street would descend at the rate of 4 per cent. on each side of the railroad. At the intersection of Crescent and Garden Streets the street would be raised 8 feet, making it necessary to change the grade of Crescent Street for a short distance.

Upon the westerly side of the track the grade at Briden Street would be raised 13 feet. Prescott Street at its intersection with Garden Street would be raised 5 feet. The grade of Prescott



Garden Street Crossing, looking west.
WORCESTER.

Street would be changed for about 150 feet north and south of its intersection with Garden Street. Briden Street would have to be raised for its entire length.

Beginning at Shrewsbury Street the work necessary to be done in lowering the tracks, aside from that already described, is as follows :

Between Shrewsbury and Summer Streets the track would be lowered 12.5 feet. This would necessitate the construction of a bank wall to support the property upon the northerly side of the railroad ; while upon the southerly side a new foundation, and basement wall of brick would be placed under C. W. Bowker's new brick building.

Between Summer and Bridge Streets the railroad would be lowered about 13.5 feet. With the exception of a short distance from Summer Street no wall would be required upon the northerly side, as most of the property is very much below the present level of the railroad. The spur track leading to Crane's lumber yard can be maintained at this level. Upon the southerly side of the railroad a new foundation and basement wall would be provided for the United States Hotel. Between the hotel and Bridge Street the land is sufficiently low to render a wall unnecessary.

Between Bridge and Exchange Streets the amount that the tracks would be lowered rapidly decreases from 14.5 feet at Bridge Street to 4.5 feet at Exchange Street. Walls would not be required upon either side of the railroad location, as Blackstone Street upon the easterly side, is now at a grade sufficiently below the tracks to render this unnecessary; while upon the westerly side the entire property should be graded to a level with the railroads. The yard of the Worcester Coal Company is upon this side of the railroad, the general level of the ground being so low, that no changes would have to be made. The coal at the present time is dumped from a track elevated on a trestle. This can be continued toward Exchange Street and the present arrangements maintained. The remainder of the land is occupied by C. Baker & Co., for a lumber yard, and the roundhouse and shops of the Boston & Maine Railroad Co.

The lumber yard is sufficiently low to require no support, but the railroad land is about 12 feet higher than the proposed new grade of the tracks. The buildings (of brick) would therefore have to be torn down and re-built if the land is to be used as at present, the difference in elevation between the proposed grade of the railroad at Exchange Street (where the connection would be made) and the turn-table at the roundhouse, being too great to operate a side track in the distance between them. This land could be used to very great advantage, both to the business interests of the city and to the railroads, if it were used as a local freight yard. The tracks can be so arranged that they can be easily reached from both Union and Manchester Streets. The roundhouse and shops can be located on vacant land north of Garden Street. This would be no more inconvenient to the Boston & Maine Railroad than for the Fitchburg road, which now has its roundhouse and shops at about the same distance from the Union Station.

The tracks crossing on the bridge over Union Street and connecting with the tracks in Foster Street can be maintained; and as they are used for local freight and are considered of great value by the Rice, Barton & Fales Manufacturing Company, and Charles Baker & Co., who use them in connection with their business, it would probably be best to allow them to remain as long as they are of value, especially as, legally, they can be operated only by horse power.

The side track connected with Gates' lumber yard can be maintained in its present location and grade.

Upon the easterly side of the railroad on Blackstone Street is located the new freight house and local yard of the Fitchburg railroad. The connection from the main track to this yard now descends rapidly toward the freight house, and crosses Blackstone and Charles Streets at grade. By the plan under consideration there will be no difficulty in maintaining this connection as all the tracks will be on the same level.

Between Exchange and Central Streets the grade of the tracks would be lowered about 4 feet. Walls would be required upon each side of the railroad location, and also upon the westerly side of the spur track leading to the Holyoke Machine Company's works. This track would remain unchanged in its location but would be lowered 2 feet where it crosses Central Street.

The repair shop of the Boston & Maine Railroad with the tracks leading to it would be lowered to conform to the new grade.

Between Central and Thomas Streets the grade of the tracks would be lowered about 3.7 feet; a new foundation would be placed under the east wall of the Holyoke Machine Company's building. Upon the easterly side of the railroad location a wall to support adjoining property would be required.

Between Thomas and School Streets the average cutting below the road bed would be 5 feet. Upon the westerly side of the tracks new foundations would have to be provided for the Holyoke Machine Company's foundry and for Lombard's Machine shop, which occupy all the space between the two streets. Upon the easterly side a retaining wall would be required. The spur track connecting with Garfield & Harrington's coal yard and Lombard's machine shed would remain in its present location slightly lowered.

Between Market Street and Lincoln Square the railroad would be lowered on an average 10.0 feet. On the westerly side the Salisbury buildings occupy nearly the entire space and would have to be provided with new foundations. Upon the easterly side the land for most of the distance is now much higher than the grade of the tracks, and is supported by a bank wall, which would have to be re-constructed. At Lincoln Square on the same side of the track the building owned by Mr. Salisbury would require new foundation walls. North of Lincoln Square the grade would rise gradually until it meets the present grade 1200 feet north of Garden Street.

By the plan under consideration all the side tracks leading to manufacturing establishments and which are used for business purposes can be preserved.

North of Lincoln Square the tracks to be lowered are the main track of the Fitchburg Railroad and two tracks of the Boston & Maine Railroad. The freight houses, freight tracks and all sidings can be preserved at their present level. The only change which is made necessary in connection with the freight yard is making the tracks of the Boston & Maine Railroad between the freight station and Lincoln Square spur tracks instead of connecting tracks as at present.

The Lincoln Square Station could be maintained at its present level, the tracks being reached by stairways.

### The Boston & Albany, New York & New England, and the New York, Providence & Boston Railroads.

Here the question of drainage again confronts us. The amount that the tracks can be lowered is dependent upon the elevation of the Mill Brook sewer, as has been shown.

The lateral sewers in the several streets crossed by the railroads are in some instances laid deep enough so that no changes will be required, while at other points the sewers will have to be lowered. At Green Street the sewer would be changed from the railroad location to Pond Street, a distance of 1000 feet. The Washington Street sewer would have to be lowered from the railroad location to Spruce Street, a distance of 1000 feet, and the Belknap Street sewer would be re-constructed at its easterly end for 50 feet to conform to the new grade. At Plymouth Street the sewer would be lowered from Belknap Street to Washington Street; this would also involve the reconstruction of a portion of the Belknap Street sewer.

No other changes would be necessary, except at Hammond and Grand Streets. The Hammond Street sewer would be reconstructed and lowered from a point 138 feet west of the railroad, to Canterbury Street, while the Grand Street sewer would have to be lowered from Illinois Street to Southgate Street, a distance of 710 feet.

By the plan under consideration it is possible to lower the tracks in the Union Station, 12 feet. The railroad grade would then descend to the location of the Mill Brook sewer, at the rate of 10.89 feet per mile.

From this point to Plymouth Street the grade would be level. Between Plymouth and Southbridge Streets the grade would descend at the rate of 23.41 feet per mile. It would then rise on the Boston & Albany Railroad to the centre of Gardner Street, the grade being 5.34 feet per mile. From this point there would be an ascending grade of 43.74 feet per mile to d

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Cambridge Street, where the present grade of the tracks would be reached.

The following table shows how much the tracks would be lowered and the streets raised upon the line of the Boston & Albany Railroad, the New York & New England Railroad, and the New York, Providence & Boston Railroad, between the Union Station and Southbridge Street, and on the Boston & Albany Railroad between Southbridge Street and Cambridge Street.

| | | Railroad Lowered. | Street Raised. | |
|---|---|---|---|---|
| Grafton | Street. | 12.20 ft. | 7.80 ft. | |
| Franklin | " | 13.50 " | 23.00 " | Street now passes under tracks. |
| Green | " | 12.70 " | 7.30 " | |
| Washington | " | 14.00 " | 6.00 " | |
| Plymouth | " | 13.50 " | 6.50 " | |
| Madison | " | 13.50 " | 6.50 " | St. does not now cross Railroad. |
| Southbridge | " | 17.00 " | 20.30 " | Street now passes under tracks. |
| Hammond | " | 16.60 " | 3.40 " | |
| Gardner | " | 16.00 " | 4.00 " | |
| Grand | " | 11.80 " | 8.20 " | |
| Cambridge | " | 0 " | 0 " | |

CAMBRIDGE STREET now passes over the railroad by a bridge.

SUTTON LANE, Webster Street, Heard Street and Ludlow Street have been provided for; a Commission appointed under the Provisions of Chapter 428 of the Acts of 1890, having decreed that Sutton Lane, Heard Street, and Ludlow Street shall pass over the railroad, and that Webster Street shall pass under the railroad.

The changes in street grades and the other work that would have to be done in carrying out the plan under consideration will now be explained.

GRAFTON STREET would be raised 7.8 feet and the track lowered 12.2 feet. The new grade of the street upon the southerly side of the tracks would descend from the railroad location to Temple Street, the grade being 3.13 per cent. The street would be raised at its intersection with Franklin Street and Bloomingdale Road 4.6 feet, while in front of Garland & Lincoln's Grain Elevator the filling would be 5.8 feet deep. Franklin Street would be regraded from Grafton Street westerly, 220 feet, and the Bloomingdale Road from Grafton Street easterly about 150 feet.

Upon the northerly side of the railroad the grade would descend into Washington Square, the grade being 3½ per cent.

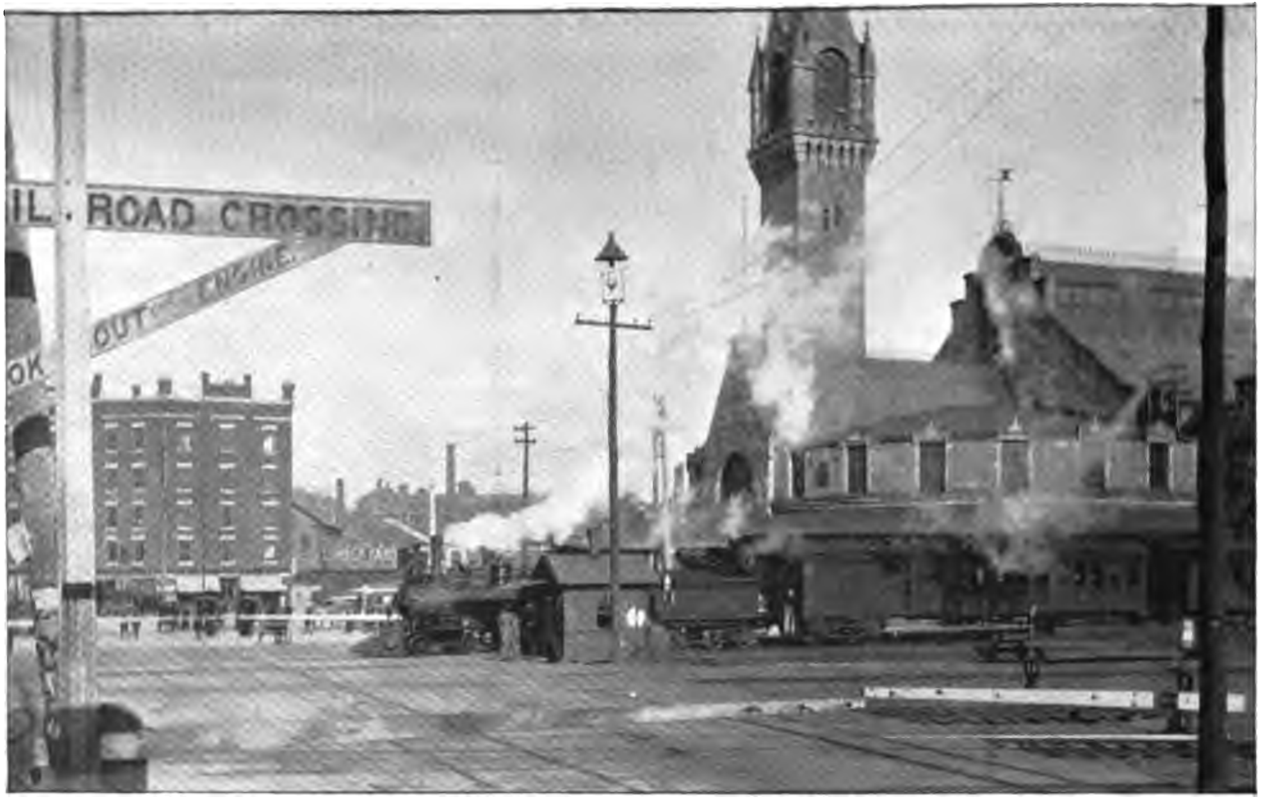
FRANKLIN STREET now passes under the tracks, the grades having been separated in the winter of 1887-1888.

By the plan under consideration the grade of the tracks would be lowered 13.5 feet and would be about 3 feet above the present street grade. The street would be raised 23 feet; this would necessitate a large amount of work, and the abandonment of the present bridge. The material can, however, be used in connection with the new work. The grade upon the easterly side of the tracks would descend at the rate of 3 per cent., intersecting the new grade from Grafton Street, at a point 220 feet from Grafton Street, thus changing the grade of Franklin Street more or less for the entire distance. Harding Street would be raised 9 feet at its northerly end and be re-graded thence to Temple Street. Upon the westerly side of the track the street would descend to Green Street, the grade being 3 per cent.

Vine Street, at its intersection with Franklin, would be raised 20 feet; the street would descend towards Front Street, the grade being 7 per cent.; it would intersect the present street grade at a point about 200 feet from Franklin Street. Foundry Street would also be raised at its intersection with Vine Street, its grade from Vine Street being 7 per cent.

GREEN STREET. This street would be raised 7.3 feet at the railroad location, the tracks being depressed 12.7 feet. The new street grade upon the southerly side of the railroad would descend at the rate of 3 per cent., joining the present street grade at Winter Street; the filling at the intersection of Green and Temple Streets would be 6.6 feet. Temple Street would therefore be re-graded for a distance of 240 feet from Green Street, the grade being 3 per cent.

Upon the northerly side of the railroad the grade would descend at the rate of 3 per cent. from the crossing, and intersect with the present street grade at Franklin Street. The depth



Union Station and Grafton Street Crossing.
WORCESTER.

of filling in front of the Trumbull property half way between Franklin Street and the railroad would be 4 feet.

WASHINGTON STREET would be raised 6 feet and the tracks depressed 14 feet, the grade of the southern approach being 3 per cent., descending from the bridge, and intersecting the present street grade at a point 40 feet south of Plymouth Street, which would be raised at its intersection with Washington Street 1.6 feet, making it necessary to grade the street for a short distance upon each side of that street. The spur track leading to William Allen & Sons' boiler works would be depressed about 12 feet, the street passing over it on an iron bridge. The filling in front of the main building of the boiler works would be 5.5 feet deep.

Upon the northerly side of the railroad location, the grade would rise from the railroad, Washington Street upon that side being much higher than the present grade of the tracks. The new street grade would rise at the rate of 1.6 per cent. and intersect with the present street grade at a point 140 feet west of the railroad location. Belknap Street, which enters Washington Street just north of the railroad, extending to Plymouth Street, parallel to and adjoining the Boston & Albany location, would be raised at each end, the filling at Washington Street would be 5.5 feet, the grade descending at the rate of 5 per cent., and intersecting with the present street grade 50 feet south of Washington Street. At Plymouth Street it would be raised 5.5 feet.

PLYMOUTH STREET would be raised at the railroad 6.5 feet and the tracks depressed 13.5. The grade as proposed upon the northerly side of the railroad location would rise from the railroad, the grade being 1.8 per cent. The new grade intersects with the present street 105 feet north of the railroad location. Upon the easterly side of the railroad location the grade would descend toward Washington Street, intersecting the new grade of that street at the junction of the two streets, the rate of fall being 3 per cent. Assonet Street, which enters Plymouth Street just east of the railroad location, would be raised 5.8 feet. The grade would extend down Assonet Street, the fall being 5 per cent., intersecting the present grade at a point 50 feet west of Gold Street.

MADISON STREET does not now cross the railroad tracks, but petitions for its extension are before the Board of Aldermen.

The grade of the railroad would be lowered 13.5 feet at this point, and the street would pass over the tracks at an elevation of 6.5 feet above the present railroad grade. The new street grade would fall from the railroad location to Portland Street, the grade being 3 per cent., the filling at Orange Street being 4.5 feet, and at Salem Street 2 feet.

The new grade of Orange Street would fall from Madison Street at the rate of 5 per cent.

Salem Street crosses Madison. The grade upon the north side would be level, intersecting the present grade 20 feet from Madison, while on the south side the new grade would descend, intersecting the present street grade 355 feet from Madison Street, the grade being 5 per cent. Upon the southerly side of the railroad, the street grade would descend to Gold Street, the grade being 5 per cent. Here there would be a fill of 17.5 feet, as this street is very much below the grade of the railroad. The grade of Gold Street would descend at the rate of 5 per cent. on both sides of the Madison Street location, joining the present grade of the street at a point 120 feet north of Gold Street Court upon the northerly side, and 430 feet south of Madison Street upon the southerly side, the filling at its intersection with Gold Street Court being 11.2 feet.

The proposed grade of Gold Street Court would descend from Gold Street, the grade being 8.5 per cent., joining the present grade at Assonet Street.

SOUTHBRIDGE STREET now passes under the railroad tracks, but by the plan under consideration it would be raised 20.3 feet, while the tracks would be lowered 17 feet or to a point nearly level with the present street grade. The new street grade upon the north side would fall from the railroad location, intersecting the present street grade at Hermon Street, the grade being 3.6 per cent. Jackson Street intersects Southbridge Street just north of the bridge; the filling at this point would be about 18 feet. This street would fall from Southbridge Street, and pass under the New York & New England freight tracks, the grade being 9.5 per cent.

Upon the southerly side of the railroads the grade of

Southbridge Street would fall at the rate of 4 per cent. for a distance of 335 feet; it would then rise at the same rate of grade, and pass over the tracks of the New York, Providence and Boston Railroad, which now pass over the street, the tracks of this road being depressed 14.2 feet, while the street would be raised about 22 feet. The street would then fall toward Hammond Street; the filling at this point would be 22.5. This amount of filling is necessary in order to obtain a proper grade for Hammond Street at its crossing with the New York & New England road, which will be described later.

After leaving Hammond Street the grade of Southbridge Street would descend at the rate of 4 per cent. and intersect the present grade about 600 feet from Hammond Street. The streets leading into Southbridge Street that would be affected by this change are Jackson (already considered), Sargent, Quinsigamond Ave., Lafayette, and Hammond. Sargent Street would be raised at its intersection with Southbridge Street, its grade being 5.56 per cent., and would intersect the present street grade at Lamartine Street.

Leading north from Sargent Street is Gold Street, which would be filled at its intersection with Sargent Street, 17.5 feet. The new grade of Gold Street would fall from Sargent Street, the grade being 5 per cent., joining the present street grade 320 feet north of Sargent Street.

Quinsigamond Avenue would be raised at its intersection with Southbridge Street 16.5 feet, and would fall toward the south, the grade being 4.9 per cent., joining the present street grade at the north line of Lafayette Street, which would be raised at its intersection with Southbridge Street 12.5 feet. The new grade of the street would descend towards Quinsigamond Avenue at the rate of 5 per cent.

HAMMOND STREET would be raised 3.4 feet, and the railroad depressed 16.6 feet. The grade upon each side of the railroad is now very steep, having a fall towards the tracks of 10.5 per cent. on the northerly side, and a fall from the tracks of 8 per cent. on the southerly side. The new grade upon the northerly side would rise from the railroad, the grade being 4.5 per cent.

It would intersect the present grade 60 feet from the railroad location. Upon the southerly side the question is somewhat complicated by reason of the location, and grade of the street crossing of the New York & New England Railroad. This road is 6.5 feet lower than the Boston & Albany Railroad where it crosses Hammond Street, while the street grade under the New York & New England bridge is 24.8 feet below the Boston & Albany tracks. The distance between the two railroads is 420 feet. At this point we will consider the Boston & Albany crossing only, although it will be necessary to bear in mind the fact that the proposed street grade between the two roads is fixed with reference to both crossings. The street upon the southerly side of the Boston & Albany tracks would descend toward Canterbury Street, the grade being 8 per cent.; this grade would be parallel to the present grade of the street. At Canterbury Street the filling would be 6 feet deep. From this point the grade would rise at the rate of 4 per cent. to the New York & New England crossing. Canterbury Street, from its intersection with Hammond Street, would have a decending grade of 5 per cent., intersecting the present street grade 300 feet from Hammond Street.

GARDNER STREET would be raised 4 feet and the railroad tracks lowered 16 feet. The new street grade upon the northerly side of the railroad would descend from the railroad location, the grade being 4 per cent. It would intersect with the present street grade at a point 170 feet west of the Boston & Albany tracks, the filling at the north-east corner of Forehand & Wadsworth's factory being 5 feet. Upon the southerly side of the railroad the street would descend towards Southgate Street, the grade being 5 per cent. At Canterbury Street the fill would be six feet deep, making it necessary to regrade the street upon each side of Gardner Street, the grade being 5 per cent.

GRAND STREET would be raised 8.2 feet and the tracks depressed 11.8 feet. The grade of the street upon the northerly side would be 4.5 per cent., intersecting the present street grade at Illinois Street.

The Knowles Loom Works occupy all the space between Tainter Street and the railroad, so that the filling would extend the entire length of their factory, raising the street grade opposite the centre of the building 3 feet.

Upon the southerly side of the railroad the grade would descend towards Southgate Street, at the rate of 5 per cent. The filling at Canterbury Street would be 2.5 feet, making it necessary to re-grade Canterbury Street for a short distance upon each side of Grand Street.

At all the streets so far considered, we have provided in the estimates of cost to follow, for constructing retaining walls upon the street lines and filling with gravel; also for re-constructing sidewalks, re-paving streets and placing them in the best of condition.

We have also estimated the amount of damage sustained by all persons whose estates are affected by the changes in streets required by the plans under consideration.

As before stated, the crossings between the Union Station and the South Worcester Station are, as a matter of convenience, called Boston & Albany crossings, although they are used by the other Southern roads.

The plan under consideration contemplates lowering all the tracks in the Union Station, and the freight tracks leading from the Boston & Albany main tracks to the freight yard, but as we have considered this matter in connection with the Union Station and tracks east of Grafton Street, we will now consider what changes would be necessary south of Grafton Street.

Between Grafton and Franklin Streets the railroads would be lowered about 13 feet, being within 2 feet of the top of the Mill Brook Arch, over which they would pass.

Upon the northerly side of the railroads are the Malleable Iron Works. It would be necessary to provide a new foundation and basement wall of brick for the building; this would be a positive benefit as the lower part of the building is now used for manufacturing purposes, the ground around being nearly as low as the proposed grade of the railroads. Between the iron works and Franklin Street no walls would be required.

Upon the southerly side of the railroads are located the car works of Osgood Bradley & Sons. These works are now connected with the Boston & Albany Railroad by two spur tracks. If these spur tracks are to be maintained, they will have to be lowered, and the works also; such a change as this would leave the floor of the shop about 20 feet below the street.

Between the car works and Franklin Street, the property is unoccupied, except by one or two small wooden buildings.

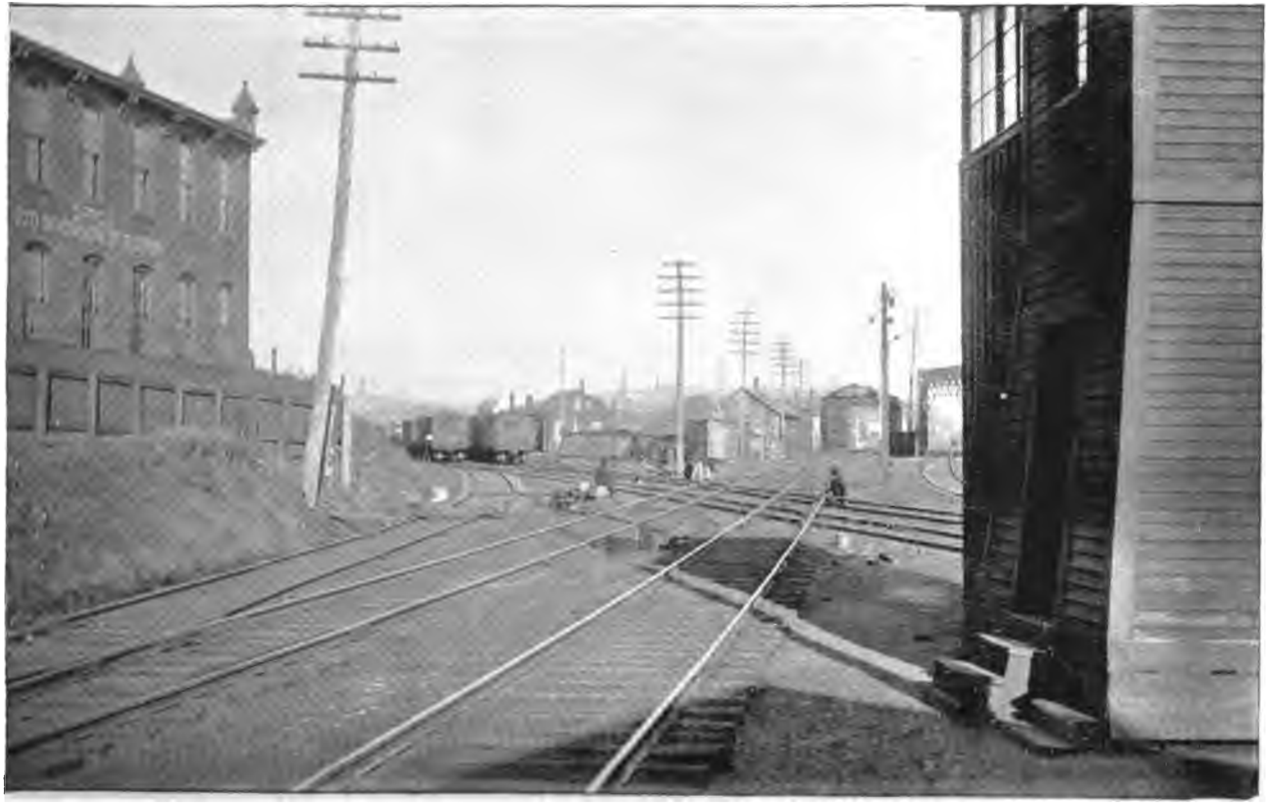
Between Franklin and Green Streets the railroads would be lowered about 13 feet. Upon the northerly side of the railroads the property would have to be supported by a retaining wall, it being covered mostly by dwellings.

Between Green and Washington Streets the tracks would be lowered about 13.2 feet. Upon the northerly side is property occupied by dwellings, which would be supported by a retaining wall. Upon the southerly side is the freight station of the New York, Providence & Boston Railroad. This, with the tracks leading to it, would have to be abandoned, as, if lowered to the new grade, it would be inaccessible from Green Street. A new location for the freight tracks and station is described further on. Upon this side of the railroad are the boiler works of William Allen & Sons, which now have spur track accommodations. The spur track leading to their works would have to be lowered about 13 feet, but could probably be used in connection with their business.

Between Washington and Plymouth streets, the tracks would be lowered about 13.7 feet.

Upon the northerly side of the railroads is Belknap Street, now supported by a bank wall. As the street should be maintained, this wall would have to be taken down and a new one constructed. Upon the southerly side of the railroads, all the land is owned by the New York, Providence & Boston Railroad, and is unoccupied except by tracks. A retaining wall would have to be constructed upon the southerly side of the track leading to the boiler works.

Between Plymouth and Madison Streets the railroad would be lowered about 13.5 feet. Upon the northerly side of the railroad the land is occupied by dwellings and would have to be supported by a retaining wall. Upon the southerly side of the tracks is the new machine shop of Caleb Colvin; this would require a new foundation and basement wall. Between this shop and the proposed line of Madison Street is Colvin's Foundry, and the coal sheds of W. H. Jourdan. The coal sheds, which would be cut in two by the extension of Madison Street, would have to be abandoned.



South Worcester Junction.

Between Madison Street and Southbridge Street the track would be lowered about 14.5 feet. For almost the entire distance upon each side of the railroad, the land is so low that no supporting walls would be required. Upon the southerly side of the railroad is the proposed location of the freight station and local tracks of the New York, Providence & Boston Railroad. Between Gold Street and the railroad there is ample room for this purpose.

Between Southbridge Street and Hammond Street the tracks would be lowered 16.0 feet. At a point just east of the South Worcester Station the freight tracks of the New York & New England Railroad cross the Boston & Albany tracks at grade. The land between this crossing and Hammond Street upon the northerly side of the Boston & Albany Railroad is from 25 to 30 feet above the rails. A heavy retaining wall would be required at this place, which would be a work of considerable cost. Upon the southerly side of the railroad location the land is unoccupied between Southbridge Street and the South Worcester Station, but between the station and Hammond Street is the New York & New England engine house, and a foundry. The land upon this side would have to be supported by a retaining wall.

The South Worcester Station would have to be abandoned, unless arrangements were made to locate it upon the southerly side of the New York, Providence & Boston Railroad at about its present level. Passengers would reach the tracks by stairways; and would pass under the freight tracks of the New York & New England Railroad, which would be elevated upon a trestle sufficiently high to pass over the Boston & Albany tracks instead of crossing at grade as at present. The arrangement of the New York & New England tracks is described further on in this report.

Between Hammond Street and Gardner Street the tracks would be lowered about 16.3 feet. As the land upon each side of the tracks is now at about this level for nearly the entire distance, but a small amount of masonry would be required.

Between Gardner Street and Grand Street, the grade of the railroad would be about 14.0 feet below its present grade. Upon the northerly side of the tracks are located the works of the

Forehand & Wadsworth Fire Arms Company, and the Knowles Loom Works. The buildings of the former company would not be disturbed, but the land would have to be supported by a retaining wall.

The Knowles Loom Works buildings are constructed so near the railroad that they would have to be provided with a new foundation, and a basement wall of brick. The spur track connected with the works would be lowered one story, or about 12 feet. Upon the southerly side of the railroad no buildings would be interfered with.

Between Grand Street and Cambridge Street the track would be lowered 11.8 feet at Grand Street, and would intersect with the present grade at Cambridge Street.

## THE NEW YORK & NEW ENGLAND RAILROAD.

We will now consider the question of depressing the tracks of the New York & New England Railroad, and as a matter of convenience will begin at Madison Street, at the terminus of the freight tracks, near the corner of Southbridge Street.

At this point would be located the new freight station of the road, and between Madison Street and the South Worcester Station would be located the new freight yard. In order to maintain this location it would be necessary to raise the freight tracks, beginning just north of Hermon Street and continuing to a point about 1000 feet north of Cambridge Street. The passenger track would be lowered so that it would be at the same level as the Boston & Albany tracks at the South Worcester Station.

The raising of the freight tracks could be accomplished in the following manner:

Beginning at the present grade of the railroad, at a point 350 feet north of Hermon Street, the grade would rise slightly to Hermon Street, where it would be 0.6 feet above the present grade. From this point to Hammond Street the grade would rise at the rate of 25.7 feet per mile, being 5.2 feet higher than the present grade at Jackson Street, 8.5 feet above the present grade at its junction with the Boston & Albany Railroad and 18.7 feet above the present grade of the tracks at Hammond Street. It would be necessary to raise the freight tracks this

amount at Hammond Street in order that the street might pass *under* this track and *over* the passenger track, as will be described later.

From Hammond Street the freight track would fall at the rate of 38.22 feet per mile to a point 1000 feet north of Cambridge Street, where the two tracks, the passenger and freight, would join. This grade would be extended to Cambridge Street, at which point the track would be 10 feet below the present street grade. From Cambridge Street the grade would rise at the rate of 29 feet per mile, and join the present grade at a point 1350 feet south of this street.

Returning to the point 1000 feet north of Cambridge Street, the passenger track would separate from the freight track and would descend to join the grade of the Boston & Albany Railroad at South Worcester. The grade would be 49.26 feet per mile to Hammond Street, which would be the lowest point reached, being about 3 feet above the present street grade. From this point the grade would rise to the South Worcester Junction, at the rate of 24 feet per mile. This arrangement is a novel one, but we can see no other way out of the difficulty if the depressed system is to be adopted, and the New York & New England freight yard maintained at its present location. The freight track would be supported by an embankment for the entire distance except between Hammond Street and Jackson Street, where a trestle would be preferable, and would pass over the Boston & Albany tracks; the improvement being the abolition of the present railroad grade crossing at South Worcester.

Between the South Worcester Station and Hammond Street a retaining wall would be required on the northerly side of the passenger track, which at Hammond Street would be 35 feet below the grade of the freight track.

Just south of the South Worcester passenger station, is the engine house of the New York & New England Railroad; this would have to be removed. The most available location is upon land near Cambridge Street.

Between Hammond and Southgate Streets a retaining wall would be required between the passenger and freight tracks, but upon the northerly side the slope of the embankment could be allowed to extend upon land to be taken for this purpose, t being much less expensive than to construct a wall.

The spur tracks used by the Wheelock Steam Engine C pany, and the Adriatic Mills, could be maintained.

Between Southgate and Cambridge Streets, walls would required between the passenger and freight tracks for about feet.

There would be no difficulty in maintaining the spur tra used by the Carpet Mills, south of Cambridge Street.

Land would have to be taken for the passenger track betw Southgate Street and the Boston & Albany Railroad, as present location of the railroad is not wide enough, but walls would be required other than these described, as the l upon the southerly side of the track is nearly on a level w the proposed grade.

The streets affected by the changes outlined above are, H mon, Jackson, Hammond, Southgate and Cambridge.

HERMON STREET now passes under the tracks; the o change necessary is to raise the bridge to conform to the n grade.

JACKSON STREET would be lowered 10 feet and the railr raised 5.2 feet, the grade of the street upon the southerly s would rise to meet the new grade of Southbridge Street descri in connection with the Boston & Albany crossing at Southbri Street.

Upon the northerly side of the railroad the grade would r at the rate of 7 per cent. The street would be lowered in fr of P. Blaisdell & Company's shop about 9 feet.

HAMMOND STREET as before stated, now passes under New York & New England tracks, and in order to meet the n grade of Southbridge Street, and to pass over the passen track and under the freight track of this road, would hav be raised 22 feet.

Upon the southerly side of the railroad the grade would level to Southbridge Street, the filling at this point being 2 feet.

Upon the northerly side of the railroad the street would scend to Canterbury Street, the grade being 4 per cent. T filling in front of the machine shop owned by the Wire Go Company would average about 16.0 feet.

SOUTHGATE STREET would pass under both the freight and the passenger tracks. The freight track would be raised above the present railroad grade 10.5 feet, and the passenger track would be lowered 3.2 feet. The street would, therefore, have to be lowered 18.2 feet. The grade of the street upon the easterly side of the railroad would rise slightly to Southbridge Street, the grade being about 0.4 per cent.

Upon the westerly side of the railroad the grade would be level to the spur track leading to the Wheelock Steam Engine Works, it would then rise at the rate of 4 per cent., joining the present street grade about 500 feet west of the railroad location·

CAMBRIDGE STREET would be raised 10 feet, and the tracks lowered 10 feet. The street grade upon both sides of the railroad would fall at the rate of 3 per cent., joining the present grade upon the easterly side at a point 280 feet from the present track, and upon the westerly side at a point about 290 feet from the track.

## THE NEW YORK, PROVIDENCE & BOSTON RAILROAD.

Returning to the South Worcester Station, the New York, Providence & Boston tracks would be lowered to correspond to the grade of the Boston & Albany and New York & New England roads. It would then continue at this elevation, being practically level, to the grade of the tracks as they are at Cambridge Street, the rails at this point being but 3 inches lower than the proposed grade at the South Worcester Station. This change involves the lowering of all the freight tracks south of Southbridge Street, and the removal of the engine house which is located near the street. The spur tracks connected with the Prentice Bros' machine shop would be maintained, the grade from the main tracks to the shop being improved.

The yard of the railroad would be lowered so as to conform to the proposed grade of the tracks at Southbridge Street. The present engine house would be torn down and a new one in the location indicated upon the plan of the depressed system could be constructed. The land upon each side of the present tracks, except for a short distance south of Southbridge Street being about 15 feet below the present grade of the railroad.

## THE BOSTON & ALBANY RAILROAD, EAST OF GRAFTON STREET.

East of Grafton Street the present grade of the Boston & Albany Railroad is level for a distance of 2000 feet. The passenger tracks of the New York & New England, and the New York, Providence & Boston Railroads end in the Union Station, while the tracks of the Boston & Albany road pass through it.

Between the Union Station and the Bloomingdale road is located the freight yard and freight station of the Boston & Albany road, a yard having a large local and through business.

If this plan is adopted, to depress the tracks in the Union Station 12 feet, having a level grade through the station, and an ascending grade of 43.6 feet per mile east of the station, joining the present grade of the tracks 1400 feet east of the station, at the point where the 30 foot grade descending from the east now ends, the tracks of the nothern roads would also be lowered 12 feet, and would connect with the Boston & Albany tracks as at present, east of the station. The main freight yard of the Boston & Albany road would be lowered to correspond to the proposed grade of the main tracks at Grafton Street. They would begin to rise at once and would join the present grade at a point 2000 feet east of Grafton Street.

The grade of the yard would be 31.7 feet per mile. The engine house east of the station could be maintained in its present location, but at the new grade. We have estimated the cost of new buildings, as the cost of lowering the present structures would probably be as great as to build anew.

The tracks used for local business, located near the freight station, could be maintained at their present level, the only change being that the connection at the westerly end with the main tracks, would be abandoned, thus making them spur tracks.

## THE VIADUCT.

The Viaduct now used for exchanging freight between the Northern and Southern roads can be maintained only by lowering its grade to correspond to the proposed grade of the railroads. This would bring the track 1.5 feet below Foster Street and 3.5 feet below the grade of Front Street. This can be done

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t interfering with the Mill Brook sewer which passes
the Viaduct. The grades of Foster and Front Streets
have to be raised so as to pass over the tracks. At
Street the elevation would be 16.5 feet above the present
at the Viaduct. To obtain a suitable grade for a street
s importance the change in grade upon the westerly side
l begin at Vine Street. The depth of filling would be
ntly increasing from this point to the Viaduct, so that at
en Street it would be 7.5 feet deep and at Canal Street
eet deep.

e grade of the side streets would be as follows, falling
Front Street.

arren Street, 5.4 per cent. to Cherry Street.
nal " 8.8 " " " " "
idge " 2.9 " " " the foot of the new grade from
oston & Maine crossing of Bridge Street.

st of the Viaduct is located Washington Square, formed by
intersection of Front, Summer, Shrewsbury and Grafton
ts. In order to obtain street grades that are at all suitable
his locality, it would be necessary to raise the grade of the
re between Grafton and Summer Streets 5 feet. If this
done the street from the Viaduct to Summer Street would
the grade being 4.1 per cent., the filling in front of the War-
Block at the corner of Hibernia Street would be 14.0 feet, and
grade of Hibernia Street would be changed for its entire
th. It would have to be filled from 14.0 feet at Front Street
bout 17.0 feet at its northerly end in order to meet the new
le at Foster Street. Foster Street at the Viaduct would
undergo radical changes. The street would be raised at
railroad crossing 18.4 feet and would pass over the tracks
tead of under them as at present. The new street grade
ld fall from the Viaduct toward Summer Street, the grade
ng 1.2 per cent., and would intersect the proposed grade of
mmer Street.

This would fill at the westerly end of the United States Hotel
ilding about 14 feet. Upon the westerly side of the bridge
e street grade would fall to Bridge Street, the grade on the
ster Street side being 2.7 per cent., and on Mechanic Street
le 5.4 per cent.

It will be seen that in reality all the property on Front Str between Vine Street and Union Station, and on Foster a Mechanic Streets between Bridge and Summer Streets wou have to be raised to conform to the changes above describe Aside from the cost of construction, the damage to valuab property would be very great. In estimating the cost of co struction we have taken into consideration the fact that th material in the Viaduct aside from the bridges can be used i this work.

In order to carry out the system of depressing the tracks, no under consideration, it would be necessary to depress them 1 feet in the Union Station. Bridges over the tracks in th station would have to be provided, and stairways sufficient t allow the patrons of the railroads to descend to the trains they wished to take without crossing any track at grade. For the purpose of making room to put in such stairways it would be necessary to change the position of all the tracks and move one main track of the New York, Providence & Boston Railroad outside of the station, placing it under a train shed to be erected for the purpose. The bridges passing over the tracks could be constructed 15 feet clearance, by permission of the Railroad Commissioners, or with floors 4½ feet above the present floor of the station, as no freight cars with brakemen on top of them pass through the station. But the plans and estimates herewith submitted are made on a basis of 18 feet clearance as required by law.

The present stone arches and gables at the ends of the station would have to be taken down and their places could be supplied with iron work and glass. Train sheds could be extended out from the main building about 150 feet to give more room. The sub-ways would be taken out and the material excavated where the tracks now are, to a depth of 12 feet. New and deeper foundations would have to be put under the walls and under the columns which sustain the roof.

The waiting and other rooms and passenger entrances would remain as they now are.

The plate opposite this page shows the changes which would be necessary in the exterior of the Station.

## ESTIMATE OF THE EXPENSE OF DEPRESSING THE RAILROADS AND ELEVATING THE STREETS AS ABOVE SET FORTH BEGINNING ON PAGE 9.

| | | |
|---|---|---|
| *Boston & Maine and Fitchburg Railroads between the Union Station and a point 1200 feet north of Garden Street.* | | |
| Expense in the streets, including bridges, damages to estates and depressing sewers, | $932,175.00 | |
| Expense along the line of the railroads including all changes in sidetracks, etc., | 333,284.00 | |
| | | $1,265,459.00 |
| *The Boston & Albany, the New York & New England and the New York, Providence & Boston Railroads, between Cambridge Street on the Boston & Albany, and a Point 1400 feet east of the Union Station.* | | |
| Expense in the streets, including bridges, damages to estates and depressing sewers, | $1,025,516.00 | |
| Expense along the line of the railroads, including changes of side tracks, etc., | 1,001,715.00 | |
| Expense in the Union Station, | 200,000.00 | |
| Expense of depressing the Viaduct, including damages to property, etc., | 282,265.00 | |
| | | $2,609,496.00 |
| *The New York & New England Railroad between a point 1350 feet south of Cambridge Street and Hermon Street.* | | |
| Expense in the streets, including bridges, damages to estates and de- | | |

| | | |
|---|---|---|
| pressing sewers, . . | $298,478.00 | |
| Expense along the line of the railroad, including changes of side tracks, etc., . . . . . | 440,803.00 | |
| *New York, Providence & Boston Railroad between Cambridge Street and South Worcester Junction.* | | $739,281.00 |
| Expense of depressing the main and side tracks and constructing the Southbridge Street bridge, . | $215,488 00 | |
| | | 215,488.00 |
| Total estimate for abolishing the grade crossings in the thickly settled part of the city as set forth on pages 12 and 21, and not including any of the outlying crossings, . . . | | $4,729,724.00 |
| The above estimate is made on the supposition that the Viaduct tracks would be depressed with the others. By abolishing the viaduct and establishing a transfer yard on the "Pine Meadow" flats, between the Boston & Albany tracks and Shrewsbury Street, this amount can be reduced, . . | $200,000.00 | |

## FIFTH METHOD.

To elevate the railroads and depress the streets.

In discussing this method of abolishing the crossings we have assumed that the citizens who advocated it designed to raise the tracks in the Union Station as much as could be done without damaging the building in its essential parts or rendering it inconvenient for use. Also that outside of the Station the tracks should be raised and the streets depressed, where necessary to depress them, over their whole width and that they should be re-paved and put in good condition, and that all buildings

affected should be provided with new foundations where necessary.

Beginning at the Union Station and going northward along the Boston & Maine and Fitchburg Railroads the changes in grade would be as follows:

| | Raise the Railroads. | Lower the Streets. | Clear head room. | Distance from surface of street to top of rail. |
|---|---|---|---|---|
| Union Station, | 12.0 ft. | | | 12.0 ft. |
| Shrewsbury Street, | 11.0 " | 7.0 ft. | 14.0 ft. | 18.0 " |
| Summer Street, | 10.6 " | 7.4 " | 14.0 " | 18.0 " |
| Bridge Street, | 5.5 " | | | 20.5 " |
| Exchange Street, | | | | Close at the R. R. location. |
| Central Street, | 13.0 " | 4.0 " | 13.0 " | 17.0 ft. |
| Thomas Street, | 15.0 " | 2.0 " | 13.0 " | 17.0 " |
| School Street, | 15.0 " | 2.0 " | 13.0 " | 17.0 " |
| Market Street, | 15.0 " | 2.0 " | 13.0 " | 17.0 " |
| Lincoln Square, | 13.0 " | 4.0 " | 13.0 " | 17.0 " |

The following is a description in detail of the changes indicated above.

At Shrewsbury and Summer Streets the railroad would be supported on iron bridges with concrete floors. The grades in Shrewsbury Street would be at the rate of 2 per cent., going from the railroad westerly, and at the rate of 3 per cent. going from the railroad easterly. A part of Mulberry Street adjoining Shrewsbury Street would have to be lowered. The grades in Summer Street would be 3 per cent. on the north side of the railroad and 2 per cent. on the south side. The depression would extend about 50 feet into Fulton Street.

Bridge Street now passes under the railroad. The iron bridge now in use there can be raised and used to support the track as heretofore. The northern end of the Viaduct would have to be raised to conform to the grade of the main tracks. The grade of the Viaduct would ascend southerly at the rate of nineteen feet per mile to Franklin Street.

Exchange Street would be closed up at the railroad location in order that the tracks in Foster Street belonging to the city and the tracks of the Boston & Maine Railroad and the local freight tracks of the Fitchburg Railroad may be maintained.

At Central Street the grade of the street would be 2½ per cent. on the west side of the railroad and 4 per cent. on the east side.

At Thomas Street the grade on the west side of the railroad would be level, and on the east side 3¾ per cent.

At School Street the grade on the west side of the railroad would be level, and on the east side 3¾ per cent.

At Market Street the grade on the east side would be 11 per cent., and on the west side level.

At Lincoln Square the grade of the street would ascend each way from the tracks. Going easterly into Belmont Street the grade would be 7½ per cent. The grade going towards and into Lincoln Street would be 3 per cent. The grade on the west side of the tracks would be 2 per cent., extending a short distance into Union, Main and Prescott Streets.

At all the streets from Central Street to Lincoln Square inclusive, we have estimated for arches spanning the whole widths of the streets, except at Lincoln Square, where there would be two arches with a pier in the middle of the Square.

Between Lincoln Square and Garden Street three tracks of the Boston & Maine and one track of the Fitchburg would be elevated. The others with the Boston & Maine freight house would be left at their present grade, only being connected with the main line at the upper end.

The side track for bulk cars near Summer Street would have to be abandoned, and also the track running down grade into Gates' Lumber Yard. The track running into Crane's Lumber Yard, and the track to Garfield & Harrington's Coal Sheds, and the track to Washburn & Moen's Machine Shop north of Market Street, would have to be raised to about the same level as the main tracks. The Fitchburg local freight yard, the tracks to Foster Street, the Boston & Maine engine house and Chamberlain's Lumber Yard could all be maintained and used at their present level; also the track leading to the Holyoke Machine Company's works, and all the side tracks between Lincoln Square and Garden Street.

The number of tracks which we have estimated for raising is as follows:

| | | | | | |
|---|---|---|---|---|---|
| Between | Union Station | and | Bridge Street, | 3 | tracks. |
| " | Bridge Street | " | Exchange " | 7 | " |
| " | Exchange " | " | Central " | 3 | " |
| " | Central " | " | Thomas " | 3 | " |
| " | Thomas " | " | School " | 3 | " |
| " | School " | " | Market " | 3 | " |
| " | Market " | " | Lincoln Square | 3 | " |
| " | Lincoln Square | " | Garden Street | 4 | " |

The grades of the railroads would be as follows, beginning at the Union Station:

| | | | | |
|---|---|---|---|---|
| Union Station | to | Bridge Street | falling | 26.8 ft. per mile. |
| Bridge Street | " | Central Street | " | 14.7 " " " |
| Central Street | " | Lincoln Square | rising | 32.7 " " " |
| Lincoln Square | " | Garden Street | falling | 17.4 " " " |

The profile following this page shows the changes above described, and an estimate is to be found on page 45.

Beginning at Cambridge Street on the Boston & Albany Railroad and proceeding eastward along the Boston & Albany, and New York & New England and New York, Providence & Boston Railroads the changes required at various points by the plan under consideration would be as follows:

| | Raise the Railroads. | Depress the Streets. | Clear head room. | Distance from surface of street to top of rail. |
|---|---|---|---|---|
| Cambridge Street | 0.0 ft. | 0.0 ft. | | |
| Grand Street | 11.0 " | 6.0 " | 13.0 ft. | 17.0 ft. |
| Gardner Street | 12.0 " | 5.0 " | 13.0 " | 17.0 " |
| Hammond Street | 7.0 " | 10.0 " | 13.0 " | 17.0 " |
| South Worcester Junction | 5.0 " | | | |
| Southbridge Street | 5.4 " | | | |
| Plymouth Street | 12.0 " | 5.0 " | 13.0 " | 17.0 " |
| Washington Street | 11.1 " | 5.9 " | 13.0 " | 17.0 " |
| Green Street | 11.8 " | 6.2 " | 14.0 " | 18.0 " |
| Franklin Street | 12.0 " | | | |
| Grafton Street | 12.0 " | 6.0 " | 14.0 " | 18.0 " |
| Union Station | 12.0 " | | | |

At Cambridge Street there would be no change. The railroad would begin there to rise.

At Grand Street the grades would be 4 per cent. each side of the railroad.

At Gardner Street the grade on the north side of the railroad would be 3 per cent., and on the south side level.

It would be necessary to change the location of Hammond Street, and the grades there would be on the north side 9 per cent., and on the south side 3 per cent.

At Southbridge Street, the present abutments could be raised the necessary amount, and the iron bridges which are now in use could be raised and used the same as heretofore.

At Plymouth Street the grades would be 10 per cent. on the north side, and 4 per cent. on the south side of the railroad.

At Washington Street the grades would be 6 per cent. on the north side, and 3 per cent. on the south side.

At Green Street the grades would be 2 per cent. on each side.

At Franklin Street the present abutments would require to be taken down and rebuilt. The present bridge could be raised to the new grade and continued in use.

About half of the Viaduct would require to be taken down and rebuilt at a higher grade.

At Grafton Street the street grades would be 2 per cent. each side.

In Union Station the railroads would be raised 12 feet throughout the station, on iron trestles, and relocated so that each would have two tracks inside the station, except the New York, Providence & Boston, which road would have one track outside. The stone arches at the ends of the station would have to be removed, and their places supplied with lighter work raised high enough to let the trains pass under.

The local freight tracks of the Boston & Albany railroad would be cut off at the west end and left as spur tracks. The western portion of the through freight yard, together with the passenger tracks, would all have to be raised. The Engine House could be left as it is, and the track to the Worcester Steel Works could be maintained though somewhat changed in position.

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The freight tracks and freight houses of the New York, Providence & Boston railroad, now situated between Plymouth and Green Streets, could be removed to the low ground between the main tracks and Gold Street.

The side tracks to the Allen boiler works and Colvin's machine shop could be retained at about their present level by connecting them with the main track at a point further west.

The grades of the railroads under this plan would be as follows :

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| From | Cambridge | Street | to | Crystal | Street | rising | 23.74 | ft. | per | mile. |
| " | Crystal | " | " | Gates | " | " | 10.03 | " | " | " |
| " | Gates | " | " | Grand | " | " | 2.54 | " | " | " |
| " | Grand | " | " | Gardner | " | falling | 8.98 | " | " | " |
| " | Gardner | " | " | Hammond | " | " | 21.12 | " | " | " |
| " | Hammond | " | " | the South Worcester Junction | | " | 16.37 | " | " | " |
| " | the South Worcester Junction to Plymouth Street, rising | | | | | | 27.45 | " | " | " |
| " | Plymouth Street to east end Union Station, passenger tracks, level. | | | | | | | | | |
| " | east end Union Station, passenger tracks, falling for a distance of about 1400 feet, | | | | | | 43.00 | " | " | " |
| " | Plymouth Street to east side Grafton Street, freight tracks, level. | | | | | | | | | |
| " | east side Grafton Street for a distance of about 2000 feet, freight tracks, falling | | | | | | 30.00 | " | " | " |

At Grand Street, Gardner Street, Hammond Street, Plymouth Street, Washington Street and Grafton Street the railroads would be carried on arches of stone and brick. At Green Street on an iron bridge with solid floor. Between the streets they would be on an earth embankment. Retaining walls would be needed for a distance of about 600 feet on one side between Southbridge Street and Plymouth Street and most of the distance from Plymouth Street to Grafton Street.

The profiles following this page show the changes that would be necessary if this plan is carried out.

An estimate of the expense will be found on page 45.

On the New York & New England Railroad the changes would be as follows:

Beginning at Southgate Street the grade of the railroad would be raised from there to Hermon Street.

At Hammond Street the railroad would be raised 4.4 feet, and in doing this it would probably be found necessary to take down the abutments and rebuild them back on the line of the street. A new bridge would then be required.

At the South Worcester Junction the railroad would be raised 5.0 feet.

It would probably be found best to remove the Engine House to the lower end of the yard, as the main tracks would be raised on both sides of it.

At Jackson Street the 6 tracks would be raised 3 feet and the street depressed 14 feet. The sewer would have to be lowered. The grade in the street would be 8.5 per cent., rising from the railroad on the west side and about 3 per cent., falling from the railroad on the east side.

The grade of the track from Southgate Street to the Junction ascends about 21 feet per mile for most of the distance. When raised according to the plan now under consideration it would be about 24.24 feet per mile all the way.

The grade from the Junction to Hermon Street would be about 10.11 feet per mile descending.

The profile following this page shows the changes above described.

An estimate of the expense will be found on page 45.

On the New York, Providence & Boston Railroad the grade would rise at the rate of 34.25 feet per mile from Cambridge Street to the South Worcester Junction, if the plan now under consideration should be adopted. At the present time the grade averages about 26.40 feet per mile. The main tracks and the yard between the junction and Cambridge Street would have to be raised. The Engine House could be maintained where it now is. The bridge over Southbridge Street would have to be raised about 3 feet.

Following this page is a profile showing the changes above described.

## ESTIMATE OF THE EXPENSE OF ELEVATING THE RAILROADS AND DEPRESSING THE STREETS AS ABOVE SET FORTH BEGINNING ON PAGE 38.

| | | |
|---|---|---|
| *The Boston & Maine and Fitchburg Railroads between the Union Station and Garden Street.* | | |
| Expense in the streets, including bridges and damages to estates, . | $212,550.00 | |
| Expense along the line of the railroads, including all changes in side tracks, . . . . . | 427,347.00 | |
| | | $639,897.00 |
| *The Boston & Albany, the New York & New England and the New York, Providence & Boston Railroads between Cambridge Street on the Boston & Albany and a point 1400 feet east of the Union Station.* | | |
| Expense in the streets, including bridges and damages to estates, . | $354,064.00 | |
| Expense along the line of the railroads, including changes of side tracks, . . . . . | 504,543.00 | |
| Expense in the Union Station, | 220,000 00 | |
| Expense of raising the Viaduct, | 100,000.00 | |
| | | $1,178,607.00 |
| *The New York & New England Railroad between Cambridge Street and South Worcester Junction.* | | |
| Expense in the streets, including bridges and damages to estates, . | $61,801.00 | |
| Expense along the line of the railroad, including changes of side tracks and buildings, . . . . | 44,863.00 | |
| | | 106,664.00 |

| | | |
|---|---|---|
| *The New York, Providence & Boston Railroad between Cambridge Street and the South Worcester Junction.* | | |
| Expense of raising the main and side tracks and the Southbridge Street bridge, . . . . | $20,769 00 | |
| | | $20,769.00 |
| Total estimate for abolishing the grade crossings in the thickly settled part of the city not including any of the outlying crossings, . . | | $1,945,937.00 |

## THE FINAL CONCLUSIONS AND RECOMMENDATIONS OF THE COMMISSION.

The greater portion of the preceding pages of this report have been devoted to the discussion and illustration of the various plans which have been brought before us for our consideration. This has been done in order that full information may be placed before the City Government and the citizens concerning these plans.

And now as we have, in the language of the order, first examined "all the grade crossings in the city," and second, have made "plans of them as they now are, together with the proposed changes," we will proceed to the third part of our duty which requires us to "report to the Board the most beneficial way to the City to have said grade crossings abolished."

In taking up this part of the question, we assume that the welfare of all the inhabitants should be considered, including those who travel upon the streets, and those who use the passenger stations and the trains, and also those whose business depends upon convenient facilities for receiving and despatching their freight.

And we perceive that, by any general change, a large number of interests will be affected, and that, whatever plan is finally adopted, it will have to be one requiring various concessions by all the parties interested, and that it is necessary to consider carefully how it will affect them.

And we believe that all the crossings should be considered together, and that the subject be dealt with as a whole; and although it is of course very uncertain what the needs of the future may be, still, so far as they can be foreseen, they should be provided for. Permanency should be provided for, and also good architectural effect, as well as safety and convenience The general plan should be such as not only to answer present requirements but to admit of the future additions and extensions which will be made necessary by increased business. True economy demands a plan, and a method of executing the same, such that the requirements of increased business and more dense population can be met from time to time, as such requirements arise, during a long term of years, without a general tearing down of work previously done and without abandoning the system adopted.

The city streets cross the tracks of six different railroads at fifty-nine places, thirty-nine of which are at the same grade; thirteen go under the track, and seven go over.

| Names of Streets. | Width of Streets. | Width on centre line of Railroads. | Names of Railroads. | How Crossing Railroads. |
|---|---|---|---|---|
| Agate Ave. | 50 | 72 | W. & S. | at Grade |
| Alvarado Ave. | 50 | 51 | W. & S. | “ Grade |
| Bigelow Lane | 33 | 33 | B. & A. | “ Grade |
| Bloomingdale Rd. | 50 | 50 | B. & A. | “ Grade |
| Boulevard | 100 | 260 | W. & S. | “ Grade |
| Brattle | 40 | 40 | F. | “ Grade |
| Bridge | 83 & 40 | 62 | B. & M., F. | Under |
| Brooks | 40 | 75 | B. & M. | Under |
| Burncoat | 50 | 65 | B. & M. | “ Grade |
| Cambridge | 40 | 41 | B. & A. | Over |
| Cambridge | 40 & 50 | 45 | N. Y. & N. E. | “ Grade |
| Cambridge | 40 | 40 | N. Y. P. & B. | Under |
| Central | 53 | 53 | B. & M., F. | “ Grade |
| Coburn Ave. | 50 | 51 | W. & S. | “ Grade |
| Exchange | 40 | 40 | B. & M., F. | “ Grade |
| Franklin | 40 | 88.8 | B. & A., N. Y. & N. E., N. Y. P. & B. | Under |

| Names of Streets. | Width of Streets. | Width on centre line of Railroads. | Names of Railroads. | How Crossing Railroads. |
|---|---|---|---|---|
| Front | 72 | 72 | Viaduct | Under |
| Grafton | 55 | 55 | B. & A., N. Y. & N. E., N. Y. P. & B. | at Grade |
| Grand | 50 | 51 | B. & A. | “ Grade |
| Garden | 35 | 36 | B. & M., F. | “ Grade |
| Gardner | 50 | 50 | B. & A. | “ Grade |
| Green | 62 | 83 | B. & A., N. Y. & N. E., N. Y., P. & B. | “ Grade |
| Hammond | 50 | 51 | B. & A. | “ Grade |
| Hammond | 50 | 50 | N. Y. & N. E. | Under |
| Harrington | 40 | 40 | B. & A. | Under |
| Heard | 49½ | 50 | B. & A. | Over |
| Hermon | 40 | 40 | N. Y. & N. E. | Under |
| Holden | 40 | 40 | F. | ‘ Grade |
| Hope Ave. | 80 | 80 | N. Y. & N. E. | “ Grade |
| Jackson | 40 | 41.5 | N. Y. & N. E. | “ Grade |
| James | 40 | 40 | B. & A., | Over |
| Lake Ave. | 40 | 40 | W. & S. | “ Grade |
| Lincoln Sq. | 146.5 | 146.5 | B. & M., F. | “ Grade |
| Locust Ave. | 40 | 60 | W. & S. | “ Grade |
| Ludlow | 50 | 50 | B. & A. | Over |
| Market | 30 | 33 | B. & M., F. | “ Grade |
| Mechanic | 62 | 72 | Viaduct | Under |
| Millbrook | 49 | 49 | B. & M., F. | “ Grade |
| Millbury, Upper Crossing. | 49½ | 74 | N. Y. P. & B. | “ Grade |
| Millbury, Lower Crossing. | 49½ | 70 | N. Y. P. & B. | “ Grade |
| Perry Court | 30 | 30 | N. Y. P. & B. | “ Grade |
| Plantation | 40 | 40 | B. & A. | Over |
| Plantation | 40 | 40 | W. & S. | “ Grade |
| Plymouth | 34 | 35.5 | B. & A., N. Y. & N. E., N. Y. P. & B. | “ Grade |
| Putnam Lane | 40 | 40 | B. & A. | Under |
| Putnam Lane | 40 | 40 | W. & S. | “ Grade |
| School | 33 | 37 | B. & M., F. | “ Grade |
| Shrewsbury | 49.5 | 78 | B. & M., F. | “ Grade |

| Names of Streets. | Width of Streets. | Width on centre line of Railroads. | Names of Railroads. | How Crossing Railroads. |
|---|---|---|---|---|
| Southbridge | 50 | 147 | B. & A., N. Y. & N. E., N. Y. P. & B. | Under |
| Southbridge | 50 | 80 | N. Y. P. & B. | Under |
| Southgate | 40 & 45 | 56 | N. Y. & N. E. | at Grade |
| Summer | 60 | 82 | B. & M., F. | " Grade |
| Sutton Lane | 40 | 40 | B. & A. | Over |
| Thomas | 45 | 45 | B. & M., F. | " Grade |
| Tracy Place | 49½ | 49½ | N. Y. & N. E. | " Grade |
| Washington | 40 | 50 | B. & A., N. Y. & N. E., N. Y. P. & B. | " Grade |
| Webster | 49½ | 50 | B. & A. | Under (ordered) |
| West Boylston | 49½ | 70 | B. & M., F. | " Grade |
| West Boylston | 49½ | 65 | B. & M. | Over |

The above table enumerates crossings only once which are crossed by more than one railroad if the tracks are near enough together to make only one road-bed. The grade crossings are divided among the railroads as follows:

Streets crossed at grade by the

| | |
|---|---|
| B. & A., N. Y. & N. E., and N. Y., P. & B., together, . | 4 |
| B. & A., alone, . . . . . . . | 5 |
| N. Y. & N. E., alone, . . . . . . . | 5 |
| N. Y. P. & B., alone, . . . . . . | 3 |
| B. & M., and F., together, . . . . . | 11 |
| B. & M., alone, . . . . . . . | 1 |
| F., alone, . . . . . . . . | 2 |
| W. & S., alone, . . . . . . | 8 |
| | 39 |

Of these thirty-nine grade crossings, we think that all south and west of South Worcester Junction, east of Union Station and north of Garden Street, can be dealt with separately, each one on its own merits. The others, Shrewsbury, Summer, Exchange, Central, School and Market Streets, and Lincoln Square crossings, and Grafton, Green, Washington and Plymouth Street crossings, lying in the central part of the city, should be considered together.

We have already expressed our opinion with reference to the Tunnel plan which was suggested for abolishing a number of the above named crossings, and with reference to the plan for removing the station and tracks out into the suburbs, and also with reference to the plan for depressing the railroads sufficiently to carry the streets over them at their present grades: and we have also given estimates and diagrams both for depressing the railroads and for elevating them.

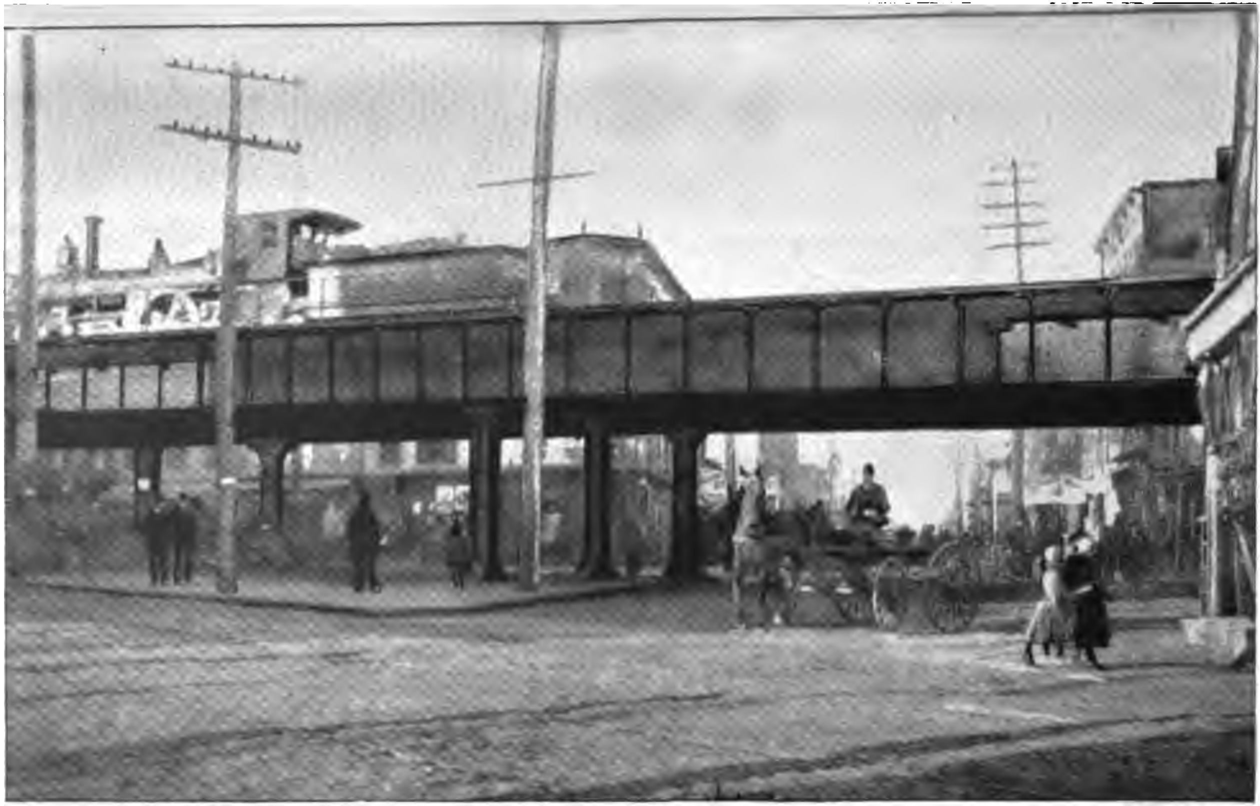
As having a bearing on the questions now under consideration, the following statement of work done elsewhere will be of interest:

In the year 1871, the Grand Central Depot in New York City, and in 1875 the Fourth Avenue Tunnel, were completed, by which improvements about forty-five grade crossings were abolished.

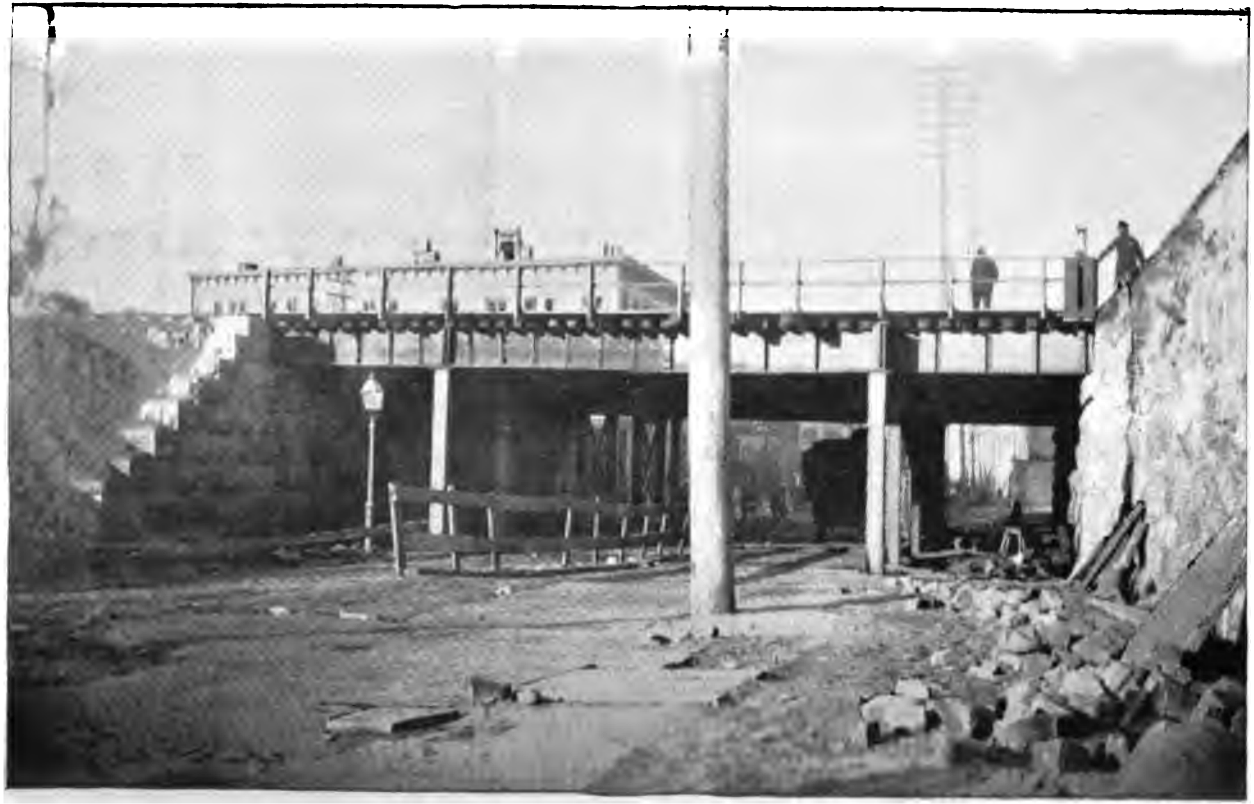
In 1886, the four tracks of the New York Central Railroad in the city of Rochester were elevated on an embankment, most of the way without walls, and twenty-one grade crossings were thus abolished. This improvement extends over a distance of about two miles. The tracks are carried over the streets o iron bridges. The expense was all paid by the railroad co pany.

At Hartford, in 1889, the New York, New Haven & Ha Railroad and the New York & New England Railroa raised 16 feet at Asylum Street, on an embankment wit ing walls, and carried over Asylum Street and Church S iron bridges. The grade of Asylum Street was lowe 2 feet. The bridges are crossed by 4 tracks.

At Springfield, in 1889, the tracks used by the Bo Albany, the Connecticut River and the New York, New Haven & Hartford Railroads, were elevated 11 feet 7½ inches at Main Street, and were carried across the street on a stone arch of 69 feet span, 7 feet rise, and 3 feet depth of keystone: while the street was depressed 7 feet. Five tracks cross this bridge.



Viaduct on Pennsylvania Railroad, leading to Jersey City Depot.



Viaduct of Pennsylvania Railroad, leading to the Jersey City Station.

On the Harlem Railroad extensive changes were made, beginning in 1886 and ending in 1891, by which the railroad was lowered for a distance of about 4.85 miles between Mott Haven and Williams Bridge in New York City. The maximum lowering of the railroad grade was 30 feet between 158th and 161st Streets. There were 14 grade crossings within the limits of the improvements. These were abolished, and together with various new streets were extended across the railroad on iron bridges. In some cases the streets were raised and in others they remained at their original grade. The width of the railroad was increased from two to four tracks. Substantially the whole cost of this work was done at the expense of the railroad company.

In Jersey City, in 1891, the Pennsylvania Railroad Company completed a railroad viaduct and a new passenger station. The viaduct is about one and one-half miles long. At the ends of the viaduct the tracks are supported on embankments of earth with retaining walls. The central portion is an iron structure for a length of 3000 feet, wide enough for four tracks, built in the middle of a street. The street under and at the sides of the iron viaduct is paved in a thorough manner, and teams pass freely through it in all directions.

By these improvements 11 very dangerous grade crossings were abolished. The tracks are carried over the streets on iron bridges, with 13 feet headroom on the important streets and with 12 feet on these of less importance. One street was depressed and another, the one next to the station, was closed up. The others were all preserved at their original grade.

This work was all done at the expense of the railroad company by agreement with the city, both parties making various concessions to each other.

In Providence the construction of the new Union Depot and terminal facilities, which work is now going on, will abolish 5 grade crossings, and provide for the extension of 2 new streets under the railroad. Here the railroads are to be raised 16 feet, and the streets to be depressed 3 feet below former grade. The streets are too near the level of tide water to admit of any greater depression.

At Philadelphia and Detroit may be seen examples of the extension of railroads across portions of those cities on viaducts.

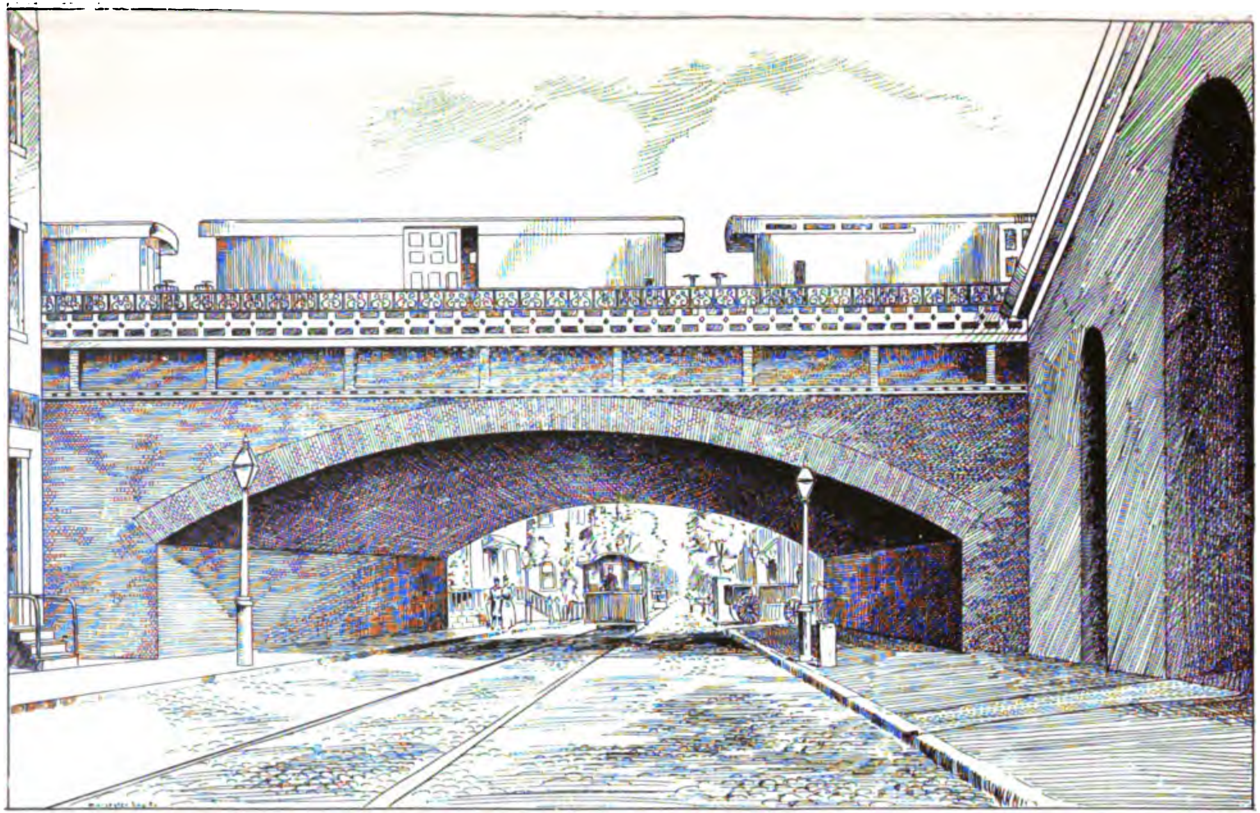
The Pennsylvania Railroad in Philadelphia was extended, in 1880, a mile or more farther into the city than it was formerly. The present Broad Street Station was then constructed, with tracks and passenger rooms in the second story. The lower story, on the level of the street, is devoted mostly to the receipt and delivery of baggage and to standing room for carriages.

Adjoining the station and extending about 2200 feet westerly from it is a brick viaduct, located between Market and Filbert Streets. This brick viaduct crosses six streets, which pass under it at their original grade. The arches thrown across the streets are of brick, and there are numerous other brick arches in the viaduct, extending through it from side to side, which are used mostly for store houses. Anthracite coal is stored in some of them. On reaching a point about two-thirds the distance from the station to the Schuylkill River, the viaduct changes from brick to iron, and its width is reduced to three tracks, and its location is changed farther to the north, into Filbert Street, where it continues until it reaches the Schuylkill River, which is crossed on an iron bridge. Under the iron viaduct teams can go in any direction, and four streets pass under it at their original grade.

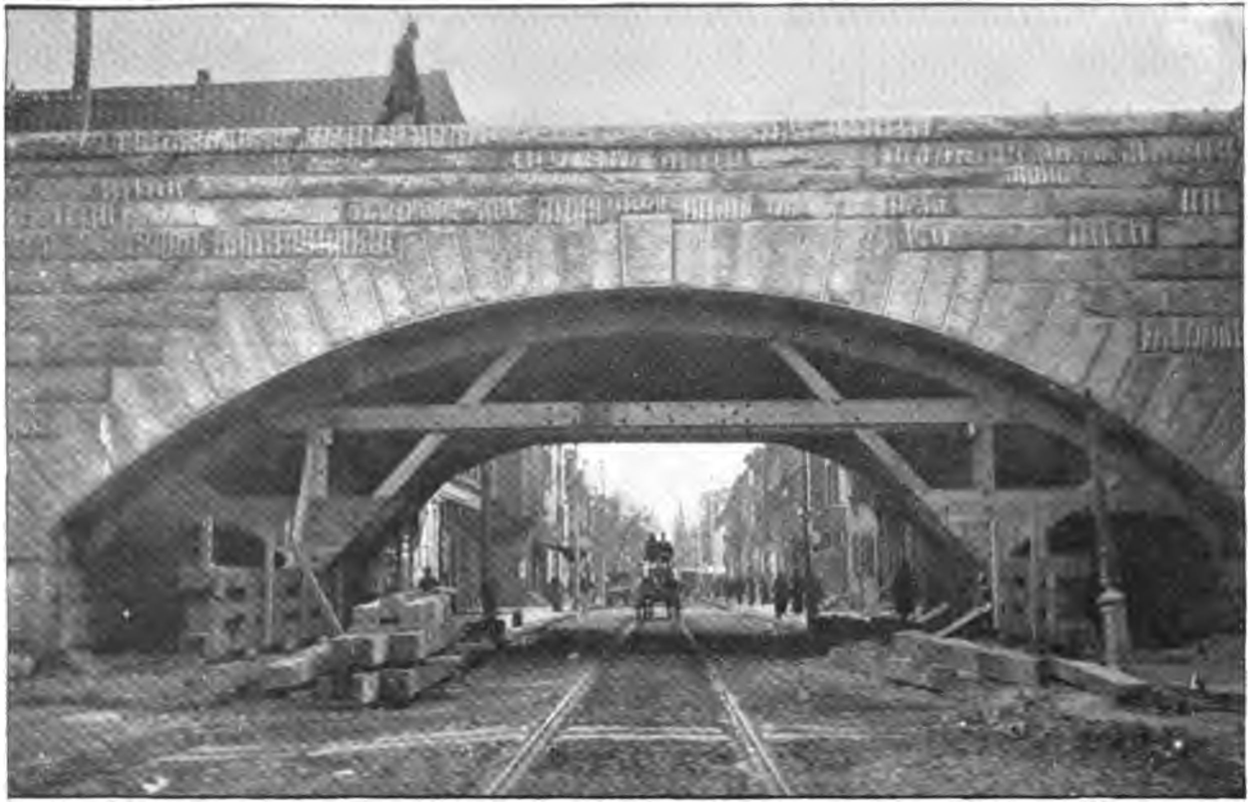
Also, in Philadelphia, the Philadelphia and Reading Railroad Company is now constructing a viaduct partly of solid embankment with retaining walls and brick arches with stone facings at the streets, and partly of iron trestles with iron bridges at the streets. This new work will be about one and one-fourth miles in length, with a new station and other buildings. About 14 streets will be crossed, all of which will remain at their present grade.

This work is done for the purpose of bringing the passenger trains nearer to the centre of business, and a further advantage will be gained in having the passenger business of the road consolidated in one station.

At Detroit, the Fort Street Union Depot Company is constructing a 2 track iron viaduct about 3000 feet long, crossing over the 13 tracks of the Michigan Central Railroad and 8 streets. Several of the streets remain at their former grades



Brick Viaduct of the Pennsylvania Railroad, leading to the Broad Street Station.
PHILADELPHIA.



Viaduct of the Philadelphia & Reading Railroad.

PHILADELPHIA.

and others are depressed a sufficient amount to allow them to go under the viaduct; but no streets are crossed at grade.

This work, as well as that in Philadelphia above described, is an extension of tracks farther into the city, and not an abolition of grade crossings; and the chief object in describing the works here is to show how they are built, as the form of construction is substantially the same as would be required if a railroad already existed there and it had been decided to raise it. But it is much more expensive of course, to elevate or depress a railroad and take care of the traffic at the same time, than it is to construct a new elevated or depressed road with no traffic to hinder the work.

At all three of the improvements at Philedelphia and Detroit, above mentioned, the grades of the streets remain unchanged and the railroads pay all the cost of the work.

In the city of Elizabeth, New Jersey, contracts have been entered into between the city and the Pennsylvania Railroad Company and the Central Railroad Company of New Jersey by which the railroads are to be elevated and the streets are to be depressed and 20 grade crossings are to be abolished. The bridges are to be partly iron bridges and partly arches of brick or stone. The railroads pay all the expense of the improvements, and the work is to be completed not later than 1895. (Copies of these contracts are printed in the Appendix.)

In the construction of railroads, especially when the question of the abolition of grade crossings is considered, it is safe to assume that where the railroads pass through a cut of any depth it will be more convenient and economical to carry the street over the tracks. On the other hand, if the railroad is constructed on low ground and the track is elevated on a fill the streets can usually be carried under the tracks to the best advantage. When the streets are important, and it becomes advisable to change the grade of the railroad, it will generally be found best to raise the track higher when it is on a fill and when it is in a cut to lower it, making a deeper cut; thus in both cases making a more favorable crossing for the street and less damage to property. It is plain that when the railroad is in a deep cut it is impracticable to run a street under it without changing the street's location, and, on the other hand, the street cannot be conveniently carried over the railroad when the latter is on a high fill.

The railroads north of the Union Station are either on a fill or else on level ground about all the way from the Union Station to Garden Street, following the valley of the Mill Brook. And the railroads west of the Union Station are on a fill or on high ground from the Union Station to Green Street, then in a cut to a point a short distance beyond Plymouth Street. Within this space are twelve grade crossings, all of them within the business part of the city and much used, being the only direct avenues of communication between the northwest and the southeast. At every one of them, except Washington and Plymouth Streets, there are important conditions which make it more desirable to raise the railroads than to depress them. At Lincoln Square the large expense of changing the grade of the main sewer and the heavy damages to estates in the Square are serious objections to depressing the railroads and raising the street there. At Market, School, Thomas, Central and Exchange Streets, the main sewer is so near the surface as to prevent the lowering of the railroad more than a very few feet as has been shown. At Summer and Shrewsbury Streets the railroad is on high ground, which descends towards the west and south, making it favorable for these two streets to go under the railroad. About the same may be said of Grafton and Green Streets. The former should plainly go under, as the railroad there is on the highest land in the vicinity, and is on about a ten foot fill most of the way to Green Street. It seems to us that there are only two streets out of the twelve we are now considering which have conditions favorable to a lowering of the tracks and a raising of the streets. These two streets will have to conform to the general system adopted and if the tracks are raised they should go under.

With reference to the system of lowering the railroads and raising the streets which has been suggested to us this would be far the most costly as is shown by our estimates on page 37 and page 38. The amount of change in the grades of the streets and the consequent damage and disfigurement to the streets and the adjacent property, and the changes necessary in the grades of the sewers, will be much greater if the railroads are depressed than will be the case if they are elevated. This is shown in the descriptions of the two systems and also by the profiles opposite pages 10, 20, 30, 33 and 34.

It seems to us quite plain that the twelve crossings above enumerated should all go under the railroads and that the railroads should be raised at each crossing.

With reference to the amount that the tracks should be raised, it seems to us that between Bridge Street and Garden Street, by elevating the railroads, the streets can be maintained at substantially their present level, while the railroad grades would not be damaged. In addition to this as has already been shown, the Mill Brook sewer located in Union Street, is within a few feet of the present railroad grade, making it difficult to depress the streets to any great extent without going to the very large expense of lowering the sewer.

We have caused an enumeration to be made at Lincoln Square, Shrewsbury, Grafton, Green, Washington and Plymouth Streets of the number of people traveling on the streets, and on the railroads during 24 hours, and we find the travel to be as is shown in the following table:

| CROSSING. | Number of People Crossing the Tracks on Foot, in Teams, and in Horse Cars. | Number of Teams. | Number of Horse Cars. | Number of Passenger Cars. | Number of People in Passenger Cars, supposing them all to be Full. |
|---|---|---|---|---|---|
| Lincoln Square . . . . . . . | 13,078 | 1,587 | 137 | 79 | 4,740 |
| Shrewsbury Street . . . . . | 13,226 | 1,935 | . . . . | | |
| Grafton Street . . . . . . . . | 13,893 | 2,596 | 48 | 231 | 13,860 |
| Green Street . . . . . . . . | 17,254 | 1,617 | 121 | | |
| Washington Street . . . . . . | 3,585 | 293 | . . . . | | |
| Plymouth Street . . . . . . . | 4,322 | 638 | . . . . | | |

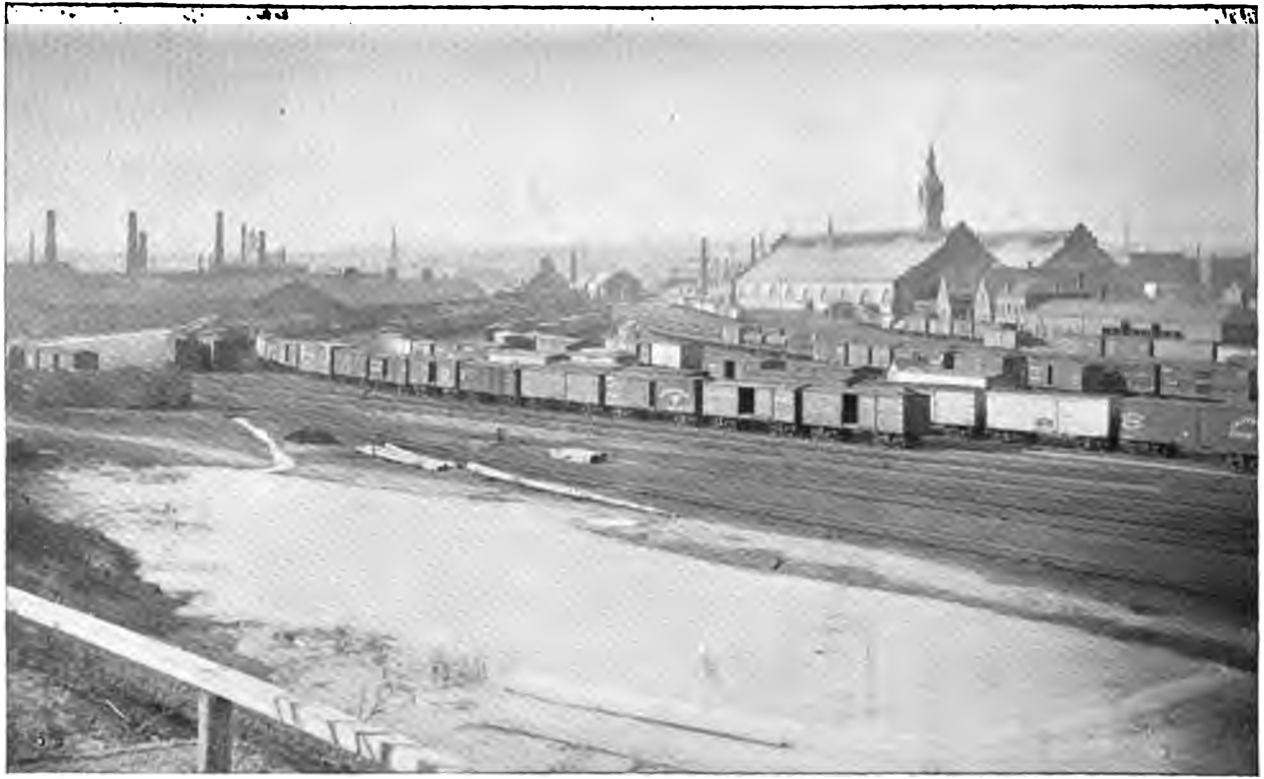
From the above table it will be seen that Lincoln Square and Shrewsbury, Grafton and Green Streets have each of them a greater number of travelers using the crossing by way of the street than by way of the train, even when counting the cars as full, which is seldom the case, as is well known.

In view of the showing made by the above table it seems very far from the truth to assume, as is sometimes done, that the railroad is the one great thoroughfare and that the city streets and the grades thereof are of comparatively trifling importance.

We suppose that it will not be disputed that the interests of the people are to be considered first in this matter. The different classes of people interested are those who travel upon the streets, those who travel upon the railroads, and those who employ the railroads to transport their freight. Their convenience and safety are to be chiefly considered.

If the tracks in and near the Union Station are elevated a reasonable amount, we fail to see how the through passengers on the railroad are put to any inconvenience whatever. They, in most cases, would never know whether the rails were laid on the ground or on a viaduct a few feet above the ground. And so far as their safety is concerned while riding over such a viaduct, it is well known that the very best railroads the world over have such structures, and they are considered entirely safe and proper. The local passengers will have to go up or down stairs in going to and from their trains if the tracks in the Union Station are raised. This has sometimes been considered a hardship, but we do not so regard it. Furthermore, stairs are absolutely necessary in order to get passengers to and from their trains without the dangerous practice of crossing tracks. And they are especially necessary in stations like this where many through trains are run on various tracks. For the aged and infirm, elevators can be provided, as is done at stations in other places. The number of local passengers is small when compared either with the through passengers or with the people who pass and re-pass upon the streets.

With reference to the travelers on the streets, we have already shown their number. They are the people and the only



FREIGHT HOUSES.

UNION STATION.

Union Station, Boston & Albany Freight Yard and Freight Stations, looking west.

WORCESTER.

people, who are liable to be put to a serious inconvenience by a wrong method of construction in this matter. If the railroads are unchanged at the Union Station and at the streets near by, the people will have to descend in the neighborhood of 16 feet at each crossing and ascend the same distance after passing the railroad tracks.

There is no comparison between such a hardship as this inflicted upon the tens of thousands who travel the streets and the slight inconvenience to the comparatively few who take the trains at this station.

With reference to the third class of people, those who employ the railroads to transport their freight, their interests need not materially be interfered with by the raising of the railroads, as all the local freight yards, except the one at Green Street, can be retained in their present position, and the private side tracks also with very few exceptions.

The inconvenience to which the railroads will be subject seems to us to consist chiefly in a slight increased fuel bill in surmounting the grades which will be introduced into the main tracks and side tracks in order to carry them over the streets; but this is in no case in excess of the grades that the same roads have got in their main lines already, while in the two northern railroads the grades of the main lines in the city will be improved.

The amount that the railroads can be raised at the Union Station is controlled to a great extent by the proximity of the Boston & Albany freight yard. We do not see how the tracks at the station can be raised more than 8 feet without either raising the whole yard and the buildings therein or else introducing very objectionable grades. The three streets nearest to the station, Summer, Shrewsbury and Grafton Streets, cannot be depressed sufficiently to go under the tracks as they are, without introducing objectionable grades in the streets with great damage to adjoining property. By raising the tracks 8 feet at the station the three streets above named can be passed under with grades that would be perfectly satisfactory.

Green Street is the principal street crossed by the southern railroads. It is the main thoroughfare to the southeastern part of the city and its grade should be changed as little as possible.

By raising the tracks at that point 15 feet and depressing the street 2 feet, the grades of the street would be maintained substantially as they are now and the grades of the railroads would not be objectionable.

Having in view the condition of things as above set forth, we recommend that the tracks in the Union Station be raised 8 feet; that the Boston & Maine and Fitchburg Railroads be raised between the Union Station and Garden Street; that the Boston & Albany, the New York & New England and the New York, Providence & Boston Railroads be raised from the South Worcester Junction to the Union Station; that the Boston & Albany yard and main tracks be raised from the Union Station 850 feet eastward, and that the outlying crossings be altered according to the table hereinafter given.

**Table Showing the Alterations Recommended by the Commission :**

| NAME OF STREETS. | Elevate Railroads. | Depress Streets. To go Under. | Depress Railroads. | Elevate Streets. To go Over. | Clear Headroom. | Surface of Street to Top of Rail. | Street Grade East or North of Railroad. | Street Grade West or South of Railroad. | Number of Tracks. | Kind of Bridges. | Width of Bridges. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Shrewsbury . . . . . . | 8.21 | 8.79 | . . | . . | 13.00 | 17.00 | 3% | | | iron | . |
| Summer . . . . . . . . | 9.60 | 7.40 | . . | . . | 13.00 | 17.00 | 3% | 1¼% | 3 | iron | . |
| Bridge . . . . . . . . | 2.00 | . . | . . | . . | 15.00 | . . | . . | . . | 3 | iron | . |
| *Exchange . . . . . . | . . | . . | . . | . . | . . | . . | . . | . . | . | . . | . |
| Central . . . . . . . . | 13.00 | 4.00 | . . | . . | 13.00 | 17.00 | 3% | 2% | 4 | arch | . |
| Thomas . . . . . . . . | 15.15 | 1.85 | . . | . . | 13.00 | 17.00 | 3% | Level | 3 | arch | . |
| School . . . . . . . . . | 14.92 | 2.08 | . . | . | 13.00 | 17.00 | 3¾% | " | 4 | arch | . |
| Market . . . . . . . . | 14.69 | 2.31 | . . | . . | 13.00 | 17.00 | 10% | " | 3 | arch | . |
| Lincoln Sq. . . . . . . | 13.00 | 4.00 | . . | . . | 13.00 | 17.00 | ‡7½% | 2% | 3 | arch | . |
| Lincoln Sq. . . . . . . | 13.00 | 4.00 | . . | . . | 13.00 | 17.00 | §3% | 2% | 3 | arch | . |
| Garden . . . . . . . . | . . | . . | . . | 20.00 | 18.00 | 20.00 | 3% | 5% | 8 | iron | 35 |
| Millbrook, new location | . . | . . | . . | 20.00 | 18.00 | 20.00 | 6% | 8.2% | 4 | iron | 25 |
| West Boylston . . . . . | . . | 16.00 | . . | . . | 13.00 | 16.00 | 4% | Level | 3 | iron | . |
| Burncoat . . . . . . . . | . . | . . | . . | 20.00 | 18.00 | 20.00 | 6% | " | 2 | iron | 35 |
| Brattle . . . . . . . . | . . | . . | 2.00 | 18.00 | 18.00 | 20.00 | Level | 8% | 2 | iron | 40 |
| *Holden . . . . . . . . | . . | . . | . . | . . | . . | . . | . . | . . | . | . . | . |
| Grand . . . . . . . . . | . . | 17.00 | . . | . . | 13.00 | 17.00 | 4% | 4% | 4 | arch | . |
| Gardner . . . . . . . . | . . | 17.00 | . . | . . | 13.00 | 17.00 | 5% | 3% | 4 | arch | . |
| Hammond, new location | . . | . . | . . | . . | 13.00 | 17.00 | 11% | Level | 4 | arch | . |
| Southbridge . . . . . . | 2.25 | . . | . . | . . | 15.00 | . . | . . | . . | 6 | iron | . |
| Madison St. Extension . | 8.00 | 10.00 | . . | . . | 14.00 | 18.00 | 3% | 3% | 6 | arch | . |
| Plymouth . . . . . . . | 9.20 | 7.80 | . . | . . | 13.00 | 17.00 | 10% | 4% | 6 | arch | . |
| Washington . . . . . . | 11.40 | 5.60 | . . | . . | 13.00 | 17.00 | 5% | 2% | 6 | arch | . |
| Green . . . . . . . . . | 15.00 | 3.00 | . . | . . | 14.00 | 18.00 | 2% | 1% | 6 | iron | . |
| Franklin . . . . . . . . | 12.60 | . . | . . | . . | 18.00 | . . | Level | 2.6% | 6 | iron | . |
| Grafton . . . . . . . . | 7.90 | 10.10 | . . | . . | 14.00 | 18.00 | 2% | ¼% | 8 | arch | . |
| Union Station, West End | 8.00 | †3.00 | . . | . . | . . | . . | . . | . . | 6 | . . | . |
| Union Station, East End | 8.00 | †3.00 | . . | . . | . . | . . | . . | . . | 10 | . . | . |
| Bigelow Lane, n'w loc't'n | . . | . . | . . | 20.00 | 18.00 | 20.00 | 2% | Level | 4 | iron | 33 |
| Bloomingdale Road . . | . . | . . | 5.00 | 15.00 | 18.00 | 20.00 | 4.3% | 4.3% | 2 | iron | 50 |
| *Tracy Place . . . . . | . . | . . | . . | . . | . . | . . | . . | . . | . | . . | . |
| Hope Av. . . . . . . . . | . . | . . | . . | 20.00 | 18.00 | 20.00 | 5% | 4% | 2 | iron | 40 |
| Cambridge . . . . . . . | . . | . . | 3.00 | 18.00 | 18.00 | 21.00 | 4% | 4% | 2 | iron | 50 |
| Southgate . . . . . . . | . . | 16.00 | . . | . . | 13.00 | 16.00 | Level | 2½% | 2 | iron | . |
| Jackson . . . . . . . . | 2.80 | 14.20 | . . | . . | 13.00 | 17.00 | 7% | 1% | 6 | arch | . |
| *Perry Court . . . . . | . . | . . | . . | . . | . . | . . | . . | . . | . | . . | . |
| Millbury . . . . . . . . | . . | . . | . . | 21.00 | 18.00 | 21.00 | 3% | 3% | 3 | iron | 49½ |
| Millbury, new location . | . . | . . | . . | 21.00 | 18.00 | 21.00 | 3.5% | 2% | 2 | iron | 49½ |

*** To be Closed at the Railroad Location. † Floor of Station. ‡ In Belmont St. § In Lincoln St.**

and at the rate of 3 per cent. for a distance of about 300 feet northerly. At Fulton Street a cutting of 3 feet in depth will be necessary, and the grade will continue along Fulton Street for a distance of about 100 feet and rising at the rate of 3 per cent. The bridge will be of iron with a solid floor. The spur track now used for bulk cars in the rear of the United States Hotel will have to be abandoned, as it will not be accessible for teams.

At Bridge Street, the tracks being raised two feet, there will be 15 feet headroom. The present bridge can be used by raising the abutments.

The Fitchburg local yard and freight house can be maintained where it is by commencing to descend at Central Street. The rate of grade of the approach to this yard will be about 100 feet per mile. The track crossing Bridge Street, leading to the Stevens Cold Storage Building can remain undisturbed.

Blackstone Street should be discontinued as a public street from the south end of the freight house to a point just north of the crossing of the Fitchburg freight tracks. Charles Street should be extended northwesterly parallel to the freight tracks until it meets Blackstone Street. Blackstone Street should be extended northerly parallel to the railroad from Exchange Street to Central Street.

The spur tracks leading to the Worcester Coal Company's sheds and to Charles Baker & Company's lumber yard can be maintained at the same level as now. The grade descending to these tracks will be about 85 feet per mile.

The side tracks leading to the Boston & Maine engine house, and to the Foster Street tracks belonging to the city, can remain undisturbed by commencing to descend at Central Street at the rate of 85 feet per mile. The present low grade track into Gates' lumber yard will have to be abandoned.

Exchange Street should be closed at the railroad location; otherwise it would be very difficult to maintain any of the side tracks in that vicinity.

The tracks north and south of Central Street, running to the repair shops and paint shop of the Boston & Maine railroad, should be removed, together with the wooden buildings, to some convenient locality farther out of the city. A part of the land

now occupied by these tracks and buildings will be needed
the purpose of extending Blackstone Street and the track le
ing to the Fitchburg local yard.

The track leading to the Holyoke Machine Company's wo
can be maintained at its present level where it crosses Cent
and Thomas Streets. The grade necessary to get down into
yard of the Machine Company will be about 40 feet per mile.

At Central Street the railroads should be raised 13 feet, a
the street depressed 4 feet; clear headroom 13 feet. Weste
from the crossing the street will rise on a 2 per cent. grade fo
distance of 120 feet. Easterly the grade will rise at the rate
3 per cent. for a distance of 150 feet. The tracks should
carried over the street on a brick or stone arch spanning its f
width.

At Thomas Street the railroads should be raised 15
feet, and the street depressed 1.85 feet; clear headroom 13 fe
Grade of the street on west side of crossing level for a dista
of about 100 feet, and on east side rising 3 per cent. for a d
tance of about 300 feet. Tracks to be supported on an a
spanning full width of street.

At School Street the railroads should be raised 14.92 fe
and the street depressed 2.08 feet; clear headroom 13 feet. T
street grade to be level for a distance of about 150 feet weste
from the crossing, and easterly from the crossing rising
per cent. for about 100 feet. Tracks to be supported on
arch spanning the full width of the street, the track cross
School Street on the east side of the main tracks, and used
Garfield & Harrington for coal purposes, and by the Lomb
Machine Shop for loading machines, can be maintained a
high level, and, for coal purposes, probably improved.

At Market Street the railroads should be raised 14.69 f
and the street depressed 2.31 feet; tracks to be supported o
arch spanning the full width of the street, with a clear headr
of 13 feet. Grade on the west side is level for a distance of ab
50 feet, and on the east side rising 10 per cent. towards the
for a distance of about 90 feet.

North of Market Street is a siding about 180 feet long on
west side of the main tracks to accommodate the machine s
of Washburn & Moen. The switch, a part of which is in

street, should be moved to the north side of the street, and the track raised so that loading and unloading can be done from the second story.

Lincoln Square should be depressed 4 feet, and the railroads raised 13 feet. Grades on the west side of the railroads 2 per cent. for a distance of about 230 feet, and on the east side, leading into Lincoln Street 3 per cent. for about 280 feet, and leading into Belmont Street 7½ per cent. for about 100 feet, all rising away from the railroads. In Lincoln Square a cutting of 2 feet will be necessary opposite Union and Prescott Streets; tracks to be supported on two arches of 59 feet span each, with a clear headroom of 13 feet. The lines of the Square should be re-adjusted on the north and east sides in order that the proposed arches may properly fit the ground.

The Station should be raised or a new one built on a level with the tracks. Between Lincoln Square and Garden Street three tracks of the Boston & Maine Railroad and one track of the Fitchburg Railroad should be elevated. All the other tracks together with the Boston & Maine freight house should be left at their present grade. Those on the west side of the main line running into the works of Washburn & Moen, to Chamberlain's lumber yard and to the yard for bulk cars adjoining Prescott Street near the depot, can all be maintained at their present level and state of usefulness by being connected with a side track leaving the main line near Garden Street. The side track running to Sawyer's lumber yard on the east side of the Fitchburg Railroad need not be disturbed, but will have to be connected to the main line at a point nearly up to Garden Street in order to obtain a favorable grade.

The tracks now used in connection with the freight house will be spur tracks. The private passage way leading to the Boston & Maine freight house from Lincoln Street, opposite Kendall Street, will pass under the Fitchburg main track by lowering it three feet. The Fitchburg track will have to be raised higher than the Boston & Maine in order to allow the private way to go under.

Garden Street should be raised 20 feet, and carried over the four tracks of the Boston & Maine Railroad, and the three tracks of the Fitchburg Railroad. It should also be carried over the side track of the Washburn & Moen Manufacturing Company. An iron trestle about 275 feet long, the full width of the street, will be required with earth fills at each end. Easterly from the trestle the street grade will descend at the rate of 3 per cent. about 280 feet, thereby requiring a fill of 14 feet at the junction of Crescent Street, the grade continuing to descend along Crescent Street. On the west side of the railroads the trestle should clear the Washburn & Moen track 15 feet, and the south approach should descend at the rate of 5 per cent. until the present grade of Prescott Street and Briden Street are reached.

Three tracks of the Washburn & Moen Manufacturing Company will cross Prescott Street at grade.

Millbrook Street crosses at grade four tracks of the Boston & Maine and Fitchburg Railroads. The location of the street should be changed about 100 feet towards the south and carried over the railroads at a height of 20 feet on an iron bridge 25 feet wide. the approaches should be of earth embankments without walls. The street grade easterly from the crossing will rise at the rate of 6 per cent., and westerly it will descend from the crossing at the rate of 8.2 per cent. This latter grade will extend about 200 feet along Byron Street.

West Boylston Street at Barber's Crossing crosses the three tracks of the Boston & Maine and Fitchburg Railroads at grade. The street should be depressed 16 feet for its full width, and taken under the tracks. The new grade on the north side of the tracks will be 4 per cent. for about 560 feet, ascending towards the north. On the south side of the tracks the grade will be level for about 370 feet. The railroads should be carried over the street on an iron bridge, with a solid concrete floor.

Burncoat Street crosses the two tracks of the Boston & Maine Railroad near the Summit Station. It should be raised 20 feet, and carried over the railroad on an iron bridge 25 feet in width. The approaches each side should be of earth embankments without walls. The street grade will descend northerly at the rate of 6 per cent. for about 350 feet. Southerly the grade will be level for about 220 feet or until the present grade is reached.

Holden and Brattle Streets. These two streets cross the

Fitchburg Railroad at the North Worcester Station. The two crossings are about 100 feet apart. They are both on an abrupt grade, rising towards the north. The railroad rises towards the northwest, at the rate of about 60 feet per mile, but there is a slight break in the grade at the North Worcester Station, and the grade of the railroad can be lowered about two feet without injury.

Holden Street should be closed where it crosses the railroad, and should be diverted and connected with Brattle Street at a point 200 or 300 feet north of the crossing.

Then Brattle Street should be raised its full width and carried over the track on an iron bridge at the height of 18 feet above its present level, the track being lowered 2 feet to make up the necessary clearance. The approaches should be embankments of earth.

The grade of Brattle Street will be 8 per cent., descending southward from the track for about 800 feet; and on the north side of the track it will be level, for a distance of about 280 feet. At the junction of Smith's Lane and Brattle Streets there will be required a fill of 16 feet which will make necessary an 8 per cent. grade descending into Smith's Lane a distance of about 290 feet. At the junction with Ararat Street there will be a fill of 5 feet.

## ALONG THE LINE OF THE BOSTON & ALBANY, THE NEW YORK & NEW ENGLAND AND THE NEW YORK, PROVIDENCE & BOSTON RAILROADS.

The railroad grades from the South Worcester Junction eastward on the Boston & Albany Railroad will be as follows:

| | | | | |
|---|---|---|---|---|
| From the junction to Green Street, rising | 32.73 | feet | per | mile. |
| Thence to Grafton Street, falling . | 30 | " | " | " |
| Thence to the east end of the Union Station, level. | | | | |
| Thence to a point about 1200 feet east of the Union Station, falling . . | 52.80 | " | " | " |
| The through freight yard of the Boston & Albany Railroad will descend from Grafton Street at the rate of . . | 30 | " | " | " |
| And the track to the freight house, | 77.80 | " | " | " |

Grand Street now crosses two main tracks of the Boston & Albany Railroad, and two side tracks which accommodate the Knowles Loom Works. The street should be depressed 17 feet and carried under these tracks, which should be supported on an arch bridge with 13 feet headroom. The grade of the street rises northerly from the crossing for about 450 feet, at the rate of 4 per cent., and southerly at the rate of 4 per cent. for about 350 feet. At the junction of Illinois and Grand Streets, a cutting of 8 feet will be necessary, and from there the grade will rise along Illinois Street at 5 per cent. for about 100 feet. At the junction with Canterbury and Grand Streets the cutting will be five feet in depth and the grade will rise along Canterbury Street at 5 per cent. for a distance of 125 feet.

Gardner Street should be depressed 17 feet and go under the railroad. The street grade should be 5 per cent. on the north side for 320 feet, and 3 per cent. on the south side about 200 feet to Canterbury Street, both rising away from the crossing, which should be supported on an arch giving 13 feet headroom, and spanning the whole width of the street. At the junction of Gardner and Tainter Streets a cutting of 2 feet will be necessary, thence the grade will rise westerly along Tainter Street at 3 per cent. for about 80 feet and easterly at 5 per cent. for about 50 feet.

Hammond Street now rises so abruptly towards the north that it cannot be carried under the railroad in its present location without great injury to its grade. The street should be relocated about 250 feet farther west and extended under the railroad. The grades will be level on the south side of the crossing for about 450 feet, and 11 per cent. on the north side, rising away from the railroad. The tracks should be supported upon an arch spanning the whole width of the street, having 13 feet headroom. At Tainter Street there will be a cutting of 4 feet, and at Canterbury Street there will be a fill of 6 feet. The side track now crossing Hammond Street at grade should be maintained.

At the South Worcester Junction change in grade will begin, and at Southbridge Street the tracks will be raised 2.25 feet. The iron bridges now standing there can be raised and continued in use. They should be provided with solid floors.

Madison Street should be extended under the railroad, and continued to the square at the intersection of Green Street and Vernon Street. The tracks should be raised 8 feet at Madison Street, and should be supported on an arch spanning the whole width of the street, and having a clear headroom of 14 feet. The street grade will descend southerly at the rate of 3 per cent. for about 280 feet on the north side of the crossing and at the same grade on the south side of the crossing to Gold Street. At Salem Street there will be a cutting of 2 feet, thence the grade will rise along Salem Street in an easterly direction at the rate of 6 per cent. for about 150 feet.

At Orange Street there will be a cutting of 7 feet, thence the grade will rise along Orange Street in an easterly direction at the rate of 6 per cent. for about 200 feet. At Gold Street there will be a fill of 3 feet.

Plymouth Street should be depressed 7.8 feet, and the railroad should be raised 9.2 feet and extended across the street on an arch spanning its whole width. The street grade on the north side should be 10 per cent. to Orange Street, and on the south side 4 per cent. for 200 feet, both rising away from the crossing. The cut on the north side will extend into Assonet and Orange Streets. At Assonet Street there will be a cutting of 6 feet, thence the grade will rise at the rate of 6 per cent. along Assonet Street for about 80 feet. At Orange Street there will be a cutting of 6 feet, and the grade will rise northerly along Orange Street at the rate of 10 per cent. for about 100 feet and southerly at 2 per cent. for about 200 feet.

Washington Street should be depressed 5.6 feet, and the railroad should be raised 11.4 feet and carried across the street on an arch spanning the whole width of the street, with a clear headroom of 13 feet. The street grades will be 5 per cent. for 250 feet on the north side and 2 per cent. for 190 feet on the south side, both ascending away from the railroad.

The side track to Colvin's Foundry and Machine Shop and the Allen Boiler Works should be maintained at about its present level, crossing Washington and Plymouth Streets at grade. The track should leave the main line at a point near Madison Street, and descend at the rate of 80 feet per mile. The cars can be moved across the streets by horse power if desired.

The freight yard and freight house of the New York, Providence & Boston Railroad should be removed, as it will be inaccessible to teams if raised with the main tracks, and cannot be left at its present grade on account of the large amount of switching necessary to be done across Plymouth and Washington Streets. This yard and freight house can be removed to the land between the main tracks and Gold Street, which will be rendered much more accessible if Madison Street is opened as we have recommended. This proposed new yard can be reached by trains on a track descending from Southbridge Street bridge on a grade of 80 feet per mile.

At Green Street the railroads should be raised 15 feet and the street depressed 3 feet. The tracks should be supported on an iron bridge, with solid concrete floor, 14 feet in the clear above the street. An iron bridge is recommended here and at Summer and Shrewsbury Streets in preference to arches for the reason that all three of these streets cross the tracks at very sharp angles; and the expense of constructing oblique arches of such large spans and with so little rise is very heavy. The grade of the street will be on the north side 2 per cent. to Washington Street and on the south side 1 per cent. for about 110 feet, both rising away from the railroad.

At Temple Street there will be a cutting of 2 feet and at Franklin Street there will be a cutting of about 1.5 feet.

At Franklin Street the railroad will be raised 12.6 feet. The abutments now standing there will have to be torn down and rebuilt if the track is raised as above indicated. The bridge now in use can be raised and used as heretofore. It should be provided with a solid floor. The surface of the street should be raised 7.1 feet, leaving a clear headroom under the bridge of 18 feet. Easterly from the crossing the street will be level for about 280 feet. Westerly it will rise on a grade of 2.6 per cent. for about 300 feet.

THE VIADUCT should be removed, and the land sold.

It cannot be maintained so as to connect the railroads with each other at the grades we recommend without tearing down about half of it and rebuilding it higher. We do not believe that the expense of rebuilding this structure is warranted by any future good that can be derived from it. It is one of those structures that are so placed as to be incapable of meeting the wants of increased business.

This Viaduct is a solid embankment of earth, enclosed by granite walls from 10 to 15 feet high, and with iron bridges across Mechanic and Front Streets. It connects the Boston & Maine and Fitchburg Railroads on the north with the New York, Providence & Boston and New York & New England Railroads on the south, and was intended for the transfer of business between these roads.

We understand that about 500 freight cars are now exchanged there daily. This work has to be done with great loss of time by locomotives and switching gangs waiting for each other and for opportunities to get in on the main tracks between regular trains. As the Viaduct is only 1,350 feet long, and as there are no adequate side tracks at hand, nor any opportunity to obtain them without great expense, the cars have to be taken away very promptly, and the switching and the inspection and handling of broken cars has to be done at a disadvantage. We do not see how the Viaduct can possibly answer the purpose much longer, and think a transfer yard will have to be built somewhere in which business can be done in the usual way.

So far as we can see, the "Pine Meadow," the tract of land between the railroad and Shrewsbury Street east of the Union Station, is the most convenient and most available place. There is plenty of unoccupied land at that point, and tracks can very easily be extended to it. In fact side tracks are already laid by which trains could be run down past the Union Station to this land from the two northern railroads. If the railroads interested could obtain from the Boston & Albany the right to run down there across that company's land, the southern railroads on the south side of the station and the northern railroads on the north side, and also could have the crossing of tracks changed from its present position west of the Union Station to a point about 1200 feet east of the station, a transfer yard could be established there sufficient for many years.

This would do away with all the delay incident to the exchange of freight, and the main tracks would be free for the forwarding of trains.

Considering the present amount of business, we doubt whether the expense of separating the grades and carrying the exchange tracks under the main tracks of the Boston & Albany would now be warranted. That could be done at some future time.

Grafton Street should be depressed 10.1 feet, and the railroad raised 7.9 feet and supported on an arch spanning the whole width of the street, with a clear headroom of 14 feet. The grades of the street will be 2 per cent. for 400 feet on the north side and ½ of one per cent. to Temple Street on the south side, both rising away from the railroad.

At Franklin Street there will be a cutting of 5 feet. The grade will rise 1.5 per cent. along Franklin Street for about 200 feet. It will not be convenient to continue in use the tracks which now enter the Bradley Car Works unless they are lowered to the new grade of the street and enter the buildings at a somewhat lower elevation than at present.

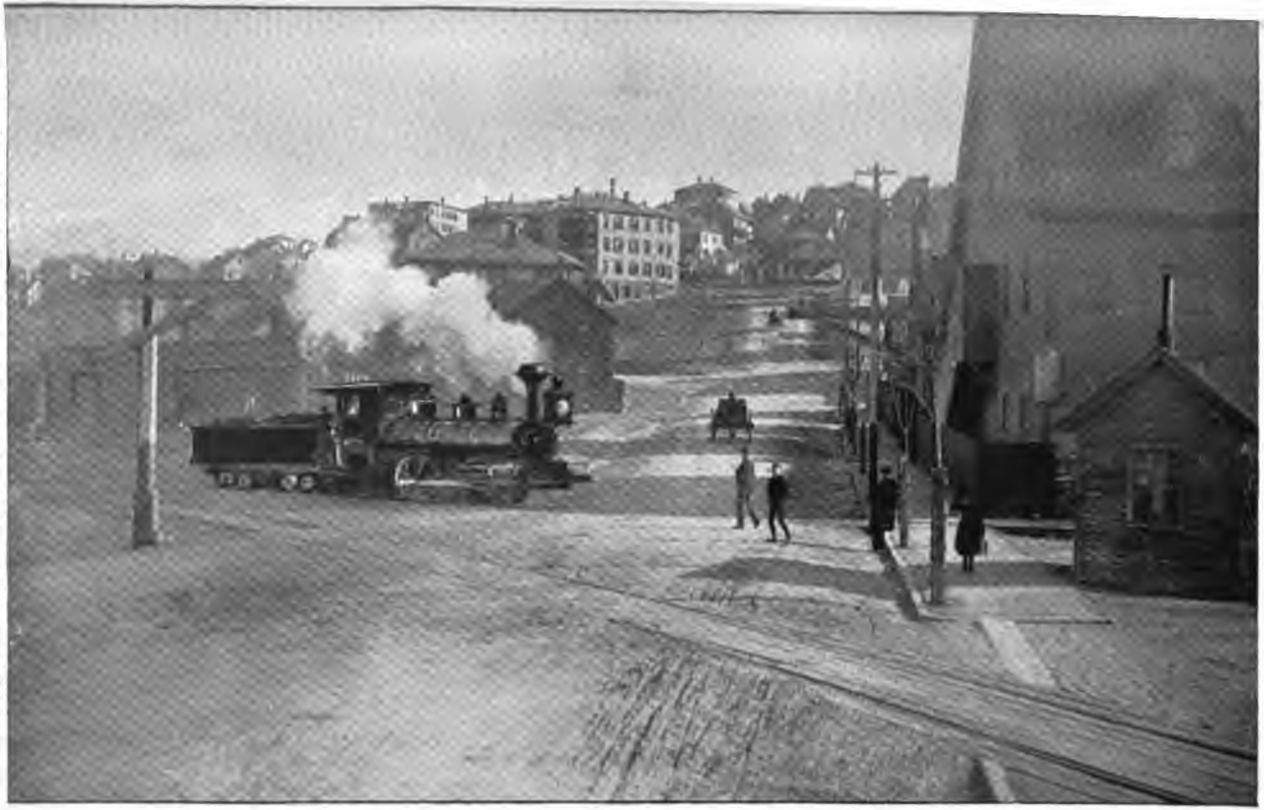
The Union Station is built with walls of granite and brick, and the roof is supported by iron trusses. The trains enter through arches at the ends and on the North side. Nine tracks enter the Station from the north and west, and the floor is level with the tops of the rails.

The tracks of the Boston & Maine, the Fitchburg, the New York & New England and the New York, Providence & Boston Railroads terminate at this Station. The main tracks of the Boston & Albany Railroad run through it.

As the Station is now used the people have free access to all the tracks and generally have to cross one or more of them to reach the trains. The danger and inconvenience arising there does not differ materially from the danger and inconvenience to pedestrians at the ordinary grade crossing.

When this Station was finished in 1875, subways and broad stairways leading to them were provided in order that travellers might pass under intervening tracks and reach their trains without danger. But as no fences or gates were erected the people would not use them. They have remained substantially unused for several years.

The station should be so arranged that passengers need not cross any track at grade. Fences should be built between the tracks, with gates capable of being opened for the passage of



Bloomingdale Road Crossing.
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baggage trucks and for the further purpose of allowing employees to pass back and forth when necessary. Passengers should be admitted to the platform along side of which their train stands by passing over or under the other tracks. The custom of allowing passengers and the general public to roam at will around the station and over the tracks is a dangerous one and ought not to be allowed.

The tracks in the Union Station should be raised 8 feet, and the floor depressed 3 feet.

From the east end of the Union Station the passenger tracks will descend on a grade of 52.8 feet per mile for a distance of about 850 feet, until the present grade is reached. The through freight tracks will descend at the rate of 30 feet per mile, and the tracks to the freight house at the rate of 77.8 feet per mile, from the centre of Grafton Street.

The freight houses and engine house can remain undisturbed.

The two tracks crossing the Bloomingdale Road, and connecting with the old freight depot, the coal dump, engine house and the Fred. W. Mann & Co. Coal Sheds could be maintained in their present location, but should be lowered at Bloomingdale Road 5 feet, and the street carried over. This can be done without creating excessive grades on either the street or the tracks. The grade of the track northerly of the Bloomingdale Road would be changed for a distance of 500 feet, the new grade being 79 feet per mile ; from the street southerly the track leading to the engine house would be 34.8 feet per mile, that leading to the coal yard of Fred. W. Mann & Co., 58 feet per mile, while the tracks leading to the old freight station, and used for bulk freight would have a grade of 68.6 feet per mile.

The track leading to the Boston & Albany coal dump would have about the same grade as at present, viz: 4 feet per 100, or about 211.0 feet per mile. These grades could be improved somewhat, but as the tracks are principally used for shifting and for local freight, the expense would hardly be warranted.

The street would be raised 15 feet at the tracks, and would have a grade of 4.3 per cent. upon each side of the bridge. This grade would extend easterly to a point opposite Suffolk Street, and westerly about 280 feet.

Upon the westerly side the new grade would intersect with the old, at the easterly end of the brick freight station; upon the easterly side the present grade of the street rises soon after leaving the railroad tracks, so that the change in the street grade would not be great at this point.

Bigelow Lane crosses the two tracks of the Boston & Albany Railroad in the eastern part of the city. This crossing should be closed, and as a substitute for it, a new overhead crossing should be provided on an iron bridge about 500 feet farther south. The ground at that point is favorable, the railroad being in a rock cut, and the bridge will be in the proper position to accommodate an extension of Hamilton Street which has been proposed. The new street will be 20 feet above the tracks and the grade near the railroad can be nearly level both sides. It will be unnecessary to carry the abutments down to the grade of the railroad.

### ALONG THE LINE OF THE NEW YORK & NEW ENGLAND RAILROAD BETWEEN THE AUBURN LINE AND MADISON STREET.

**TRACY PLACE AND HOPE AVENUE** cross the two tracks of the N. Y. & N. E. Railroad near Auburn line.

Tracy Place should be closed at the railroad location, and connected with Hope Avenue. Hope Avenue should be carried over the railroad on an iron bridge 40 feet wide, with approaches on earth embankments. The grade on the east side of the railroad should be 5 per cent., extending to Southbridge Street and along the same, northerly, about 350 feet, and southerly about 300 feet, and on the west side of the railroad the grade should be 4 per cent. for about 340 feet, both descending away from the track.

**CAMBRIDGE STREET** crosses one track of the N. Y. & N. E. Railroad. It should be raised and carried over the railroad on an iron bridge 50 feet wide, with approaches on earth embankments, the tracks having been first depressed 3 feet. The tracks can be depressed without any trouble, as there is a summit at this crossing. The street should be raised 18 feet, giving headroom of 18 feet. The grades in the street will be 4 per cent. each side, descending from the railroad; westerly for a distance of about 400 feet, and easterly 360 feet.

SOUTHGATE STREET crosses two tracks of the N. Y. & N. E. Railroad. It should be depressed 16 feet and carried under the track at its full width. The grade on the west side rising away from the track will be 2½ per cent. for 500 feet; while on the east side it will be level for about 300 feet. There will be a cut at Adriatic Street of 14 feet, and the cutting will extend in Adriatic Street about 400 feet.

JACKSON STREET should be depressed 14.2 feet and the tracks should be elevated 2.8 feet, giving a clear headroom of 13 feet. The grade of the street will ascend northerly from the crossing at the rate of 7 per cent., and there will be a cut of 2 feet at Beacon Street which will extend a short distance southerly in Beacon Street. On the southerly side of the crossing the grade will be at the rate of 1 per cent., rising to Southbridge Street, where it will end. The tracks should be supported on an arch of brick spanning the whole width of the street.

MILLBURY STREET crosses the New York, Providence & Boston Railroad twice at Quinsigamond Village. The upper crossing at the Washburn & Moen Wire Works should be discontinued, for the reason that a separation of the grades at this point cannot be accomplished without great cost and serious inconvenience to the Washburn & Moen Co. The street passes over the Blackstone River on an iron bridge, within about 200 feet of the crossing. The grade of the street cannot be lowered at this point, as the bridge is now as near the surface of the water in the river during freshets as it is advisable to have it. It is therefore impracticable to carry the street under the tracks as they now are. If the railroad grade were raised so as to pass over the street at a height sufficient to give the necessary headroom, the tracks leading into the company's works would probably have to be abandoned; and if the street were raised so as to pass over the tracks, it would completely cut off all communication between the street and the mill and mill yard. It therefore seems to us that a new street should be laid out, crossing over the railroad on an iron bridge 50 feet wide and 142 feet span, near Maxwell Street and about 1600 feet north of the present crossing, as shown on map. The approaches should be on earth embankments. The new street should cross the pond of the Washburn & Moen Company on a fill

and an iron bridge of 100 feet span, and join Millbury St
about 120 feet south of Taylor Street. The grades of the
street would not anywhere exceed 3.8 per cent. By the clo
up of the present location of Millbury Street, between Ta
Street and the northerly line of the wire works, the dange
crossing at grade of the private tracks leading into the c
pany's yard will be avoided. The distance to the city by
new location proposed above is the same as by the pre
street.

The lower MILLBURY STREET crossing should be car
over the railroad on an iron bridge 50 feet wide, at a heigh
21 feet above the tracks. The grade should be 3 per cent.
sides of the railroad and for a distance of about 420 feet no
erly, and about 540 feet southerly. The street will be raise
front of 12 houses from 5 to 15 feet.

A short distance south of the lower Millbury Street cros
is PERRY COURT. This crossing should be closed.

THE WORCESTER & SHREWSBURY RAILROAD is a l
narrow gauge railroad only 2¾ miles long, running from
Union Station to Lake Quinsigamond, and for a part of the
the rails are laid in Shrewsbury and East Worcester Stre
It has been stated that the owners of this railroad contemp
changing the motive power, at an early date, from stea
electricity. If this is done, these crossings will no longe
grade crossings within the meaning of the law. As this cha
of motive power is entirely feasible, we have made no esti
for abolishing any of the crossings on the line of this railr
The trains of this road consist of one or more small nar
gauge cars and a dummy engine, and it is claimed by the c
pany that no one has ever been injured at the crossings.
while the crossings of the Worcester & Shrewsbury Rail
are not so dangerous as where trains are run at full speed,
are certainly not exempt from danger, and they are grade cr
ings. If the motive power is not changed, the track ough
be removed from Shrewsbury and East Worcester Streets.
at the 8 places where the track crosses streets, the grades sh
be separated by raising the track and carrying it over
streets at Putnam Lane, Locust Avenue, Alvarado Ave
Coburn Avenue, Agate Avenue, Lake Avenue and the Bo

ard, and by depressing the track and carrying it under the reet at Plantation Street.

## BRIDGE FLOORS.

The ordinary railroad bridge floor is a very unsatisfactory ing to have over a city street. The noise of trains when assing at fast speed across such a bridge is very annoying and equently frightens horses. Grease from the cars and engines and om the track falls upon the street beneath. The ties and rails re apt to become very dirty in the vicinity of stations and ards where trains are accustomed to stop and where switching done. When it rains or when snow or ice thaws the water, hich drips from the bridge upon the street below, is apt to be irty. Those walking upon the sidewalk can be partly protected as is often done, by a wooden roof extending to the curbtone which is necessarily a somewhat uncouth and disagreeable tructure, but it is impracticable to protect the people passing the drive-way when this kind of a floor is used. The water hich runs down between the tracks along the railroad embankent, is very apt to be neglected and allowed to run down over e face of the abutment to the sidewalk and make a very disareeable state of things. And in the winter the drippings enerally freeze upon the face of the abutment and upon the idewalk.

All of these annoyances can be avoided by the construction f brick or stone arches to carry the tracks over the city streets herever the span and the amount of available height will admit f it. At all other places iron bridges with solid water-tight ncrete floors should be constructed. Such floors are now eing constructed in Providence and one such floor has been in se in this state for 3 years at Saundersville on the New York, rovidence & Boston Railroad.

## GRADES AND FREIGHT YARDS.

We have recommended grades in streets not to exceed 3 er cent. where practicable. This is a very easy grade. The rade of Foster Street between the Viaduct and Summer Street about that.

In other places where very light grades are not practicable we have recommended as high as 6 per cent., and in no case over that amount unless the street already has as much or more grade near by. An example of a 6 per cent. grade may be seen in Main Street near Tirrell Street.

In planning the railroad grades we have found it easy to improve them on the Boston & Maine and Fitchburg Railroads as will be seen by an inspection of the profile. But on the Boston & Albany, the New York & New England and the New York, Providence & Boston Railroads we have recommended slightly increased grades, but in no case such as to be difficult of operation.

In the Boston & Albany yard and on various side tracks we have recommended grades to be put in where none heretofore existed. These we think are nothing worse than what may be found on various roads.

For instance, we have recommended a 30 foot grade in a portion of the Boston & Albany yard and 77.8 foot grade in the western end of the local tracks which lead to the freight house: also a 100 foot grade in the approach to the Fitchburg freight house and heavy grades in other sidings leading to private property. We do not see that these ought to cause any anxiety as the same grades may be found in the side tracks of first class roads. The new approach to the freight tracks at the wharves of the Pennsylvania Railroad in Jersey City will be on a grade of 92.4 feet per mile, and on the same road in Philadelphia all the freight going to and from the local freight yard on Market Street has to go over a 74 foot grade in order to cross overhead the Philadelphia, Wilmington & Baltimore division. And the whole passenger business of the Philadelphia, Wilmington & Baltimore division goes into Philadelphia over a grade of 63.4 feet, and on a 12° curve, and that which leaves going south, every train, runs down a grade of 158.4 feet and on a 11° 32′ curve at the same time. In Worcester the Fitchburg Railroad voluntarily built a part of the approach to their freight house on a 211 foot grade. This might have been made much less by raising the site of the freight house and yard before building, but the road, apparently, did not think the improvement of the grade worth the expense involved, and they were probably right.

With reference to local yards accessible at only one end, while these are not quite so convenient as when they are open at both ends, we do not expect that great objection will be made when we consider the fact that the railroads have voluntarily constructed three such yards in the city of Worcester alone.

## PROVISIONS MADE FOR THE FUTURE.

It will be seen that we have provided for maintaining all the streets, except at two outlying crossings, at their full widths where they cross the railroads. Also we have provided for the extension of one new street under the railroad and for the closing up of another in a part of the city where the outlets are numerous. The over and under crossings which we have provided for in the central part of the city will be sufficient for many years both as to number and dimensions. In the suburbs new streets can be opened and extended over or under the railroads hereafter as they are needed.

An additional track will be available for trains between the South Worcester Junction and the Union Station after the freight house is removed from Green Street. For about two-thirds of the distance from the Union Station to Garden Street the railroads now own land enough for four main tracks and they could be laid if desired. But owing to the great expense of acquiring land at places where large and expensive buildings now occupy it, and the other heavy expenses incident to the widening of the railroads, we do not anticipate that any more main tracks than we have provided for will be demanded for a long time. Six main tracks from the South Worcester Junction to the Union Station and three main tracks from Lincoln Square to the Union Station are, with proper terminals, ample for handling a traffic much greater than that now handled here. The approach to the Broad Street Station of the Pennsylvania Railroad in Philadelphia has only three tracks. The new viaduct leading to the new passenger station of the same railroad in Jersey City has only four and the Cannon Street Station in London only five.

The tracks ought to be protected by interlocking switches and signals and those approaching the station used jointly to some extent as is done in various other places.

The removal of the Viaduct will be a great help to the despatch of business if a good exchange yard is provided in the "Pine Meadow" as we have herein recommended.

We have provided for allowing private side tracks to cros streets at grade at ten different points. In all these cases the freight cars to be moved will be few in number and, if desired, horse power can be used for moving them.

### ESTIMATE OF THE EXPENSE OF EXECUTING THE PLAN RECOMMENDED BY THE COMMISSION.

*Along the line of the Boston & Maine and Fitchburg Railroads.*

| | | |
|---|---|---|
| Expense of raising the railroads and changing the side tracks between the Union Station and Garden Street, | $409,347.00 | |
| Expense in the streets, including bridges and damages to estates, | 212,550.00 | |
| Expense at Garden Street, | 40,000.00 | |
| " " Millbrook " | 14,000.00 | |
| " " West Boylston Street, | 25,500.00 | |
| " " Burncoat " | 17,000.00 | |
| " " Brattle " | 50,000.00 | |
| | | $768,397. |

*Along the line of the Boston & Albany Railroad.*

| | | |
|---|---|---|
| Expense of raising the railroads and changing the side tracks between the South Worcester Junction and a point 850 feet east of the Union Station, including the tracks of the New York & New England and the New York, Providence & Boston Railroads, | $400,138.00 | |
| Expense in the streets, including bridges and damages to estates, | 438,964.00 | |
| Expense at Grand Street, | 27,267.00 | |
| " " Gardner " | 18,282.00 | |
| " " Hammond Street, new location, . . . | 54,012.00 | |
| Expense at Union Station, | 150,000.00 | |
| " of New Transfer Yard, | 50,000.00 | |
| | | $1,138,663. |

*Along the line of the New York & New England and New York, Providence & Boston Railroads, south of South Worcester Junction.*

| | | | | |
|---|---|---|---|---|
| Tracy Place and Hope Avenue, | | | $31,000.00 | |
| Cambridge Street, | | . . | 32,000.00 | |
| Southgate | " | . . | 30,500.00 | |
| Millbury | " | lower crossing, | 35,000.00 | |
| Millbury, | " | new location, | 58,500.00 | |
| | | | | $187,000.00 |
| Total estimate, including all grade crossings in the city, | | | | $2,094,060.00 |

The above statements and recommendations are respectfully submitted for your consideration; and we desire to add that, in our opinion, nothing further should be done in abolishing the crossings in the central part of the city until a well defined plan has been fully decided upon and adopted.

CHARLES A. ALLEN,
AUGUSTUS W. LOCKE,
JOHN W. ELLIS,
*Commissioners.*

February 1, 1892.

# APPENDIX.

**This Agreement**, made this twenty-fourth day of December, eighte hundred and ninety, between the UNITED NEW JERSEY RAILROAD AN CANAL COMPANY, and the PENNSYLVANIA RAILROAD COMPANY, its lesse for the first part; and the CITY OF ELIZABETH, of the second par *Witnesseth:*

Whereas, The main line of the railroad owned and operated by the sai party of the first part enters the corporate limits of the said city near th intersection of Fay Avenue and the boundary line between said city an the Township of Linden, and extends thence across the said city and acros certain public streets and avenues therein, and across the railroad of th Central Railroad Company of New Jersey to a point near the intersectio of Jefferson Avenue and the boundary line between said city and the township of Clinton in Essex county. And the said railroad has so entered th corporate limits of the said city, and has so extended across the same fo more than eighteen years last past continuously, and during all that tim the said railroad has been owned, maintained and operated by the said party of the first part in the business and occupation of carrying passengers and transporting freight and merchandise through the said city on its said railroad, and the said party of the first part still uses and operates; and intends to continue to use and operate its said railroad through the said city.

And whereas, To elevate the grade of said railroad through the said city, and to vacate, alter the lines and change the grades of certain streets and avenues within the said city, as hereinafter provided, would secure greater safety to persons and property in the said city, and promote the interests thereof, and increase the capacity of the party of the first part for transacting its business, and the City Council of the said City of Elizabeth having by their resolution passed the nineteenth day of December, A. D., 1890, authorized the following specifications of agreement, and ordered this contract to be made and executed.

Now therefore, It is hereby agreed by and between the parties hereto in pursuance of an act entitled "An act to authorize any city of this state to enter into contracts with railroad companies whose roads enter their corporate limits, whereby said companies may relocate, change or elevate their railroads, and when necessary for that purpose to vacate, change the grade of or alter the lines of any streets or highways therein," approved

March 19, 1874, and by virtue of the power and authority therein contained, and thereby conferred, and by virtue of all other powers and authority possessed by the parties hereto, or either of them, for the purpose, and in order to obtain the mutual benefits and advantages above recited, that the said party of the first part shall and may elevate the tracks of its railroad in and through the said city from a point at or near North Avenue to a point at or near Bayway; and in order to provide under grade crossings for pedestrians and vehicles of all kinds, the following changes shall be made by the said party of the first part in the grades, lines and location of certain streets and avenues in the said city at the places where the same now cross the railroad of the said party of the first part, or shall be made to cross the said railroad in pursuance of this agreement, viz:

(1.) North Avenue to be depressed thirteen feet; clearance eleven feet; grade of approach east side four feet; west side five feet, per hundred.

(2.) Fairmont Avenue to be depressed eleven and six-tenths feet; clearance thirteen feet; grade of approach east side four feet, west side two and six-tenths feet, per hundred.

(3.) Mary Street to be depressed six and seven-tenths feet; clearance thirteen feet; grade of approach east side three feet, west side two feet, per hundred.

(4.) Magnolia Avenue to be depressed three and eight-tenths feet; clearance thirteen feet; grade of approach east side to descend from the railroad six-tenths of a foot, west side to ascend nine-tenths of a foot, per hundred.

(5.) Chestnut Street to be opened for all street and highway purposes under the railroad of the party of the first part, and depressed two feet and fourteen one-hundredths of a foot below the rails of the said railroad; clearance thirteen feet; grade of approach east side to descend from the railroad one foot per hundred, west side to ascend one foot per hundred.

(6.) Broad Street to be slightly deflected and changed, as shown on the diagram hereto annexed; clearance at least thirteen feet, grade not to be changed by the said party of the first part.

(7.) At Morris Avenue a bridge shall be built by the said party of the first part, west of the present crossing of the Central Railroad of New Jersey, said bridge to be at least fifty feet wide and to have a clearance of at least twelve feet, to enable the said party of the second part to change the lines of said avenue, as shown on the diagram hereto annexed.

(8.) The grade of West Grand Street not to be changed, but the street to have a clearance of at least thirteen feet.

(9.) West Jersey Street to be depressed about two feet; clearance thirteen feet; approaches on each side to be made to conform to the depression and to have an easy grade.

(10.) The location of Union Street to be changed so as to run from West Jersey Street to Murray Street along the easterly side of the railroad of the said party of the first part, and to be fifty feet wide, and a new street to be laid out, opened, graded and dedicated, forty feet wide, by the said party of the first part, from a point on the southerly side of West

Jersey Street, one-hundred and forty feet west of Union Street as now laid out, to Murray Street, at a point one-hundred and seventy feet west of Union Street as now laid out; Murray Street, across said railroad, between Union Street and said new street, to be vacated by said city as soon as the said party of the first part opens the said new street and changes the location of Union Street.

(11.) Rahway Avenue and Cherry Street to be united west of the railroad of the party of the first part, and to cross under the same at right angles thereto at a width of sixty feet; to be depressed three and six-tenths feet below the present grade of the tracks of the said railroad, and have a clearance of thirteen feet; grade of approach on the west side of said railroad to be four feet per hundred; the said party of the first part to open a new street sixty feet wide along the east side of the railroad from Rahway Avenue to Cherry Street, and grade, curb and flag the same as said street and Avenue are now graded, curbed and flagged; the approach to said undergrade crossing by way of said new street shall be three feet per hundred from Cherry Street, and six-tenths of a foot per hundred from Rahway Avenue.

(12.) Pearl Street to be depressed five and five-tenths feet, clearance twelve feet; grade of approach east side three feet, west side four feet, per hundred.

(13.) South Street to be depressed seven feet; clearance eleven feet; grade of approach east side four feet, west side four feet, per hundred.

(14.) Bayway to be depressed thirteen feet; clearance eleven feet; grade of approach east side four feet, west side five feet, per hundred.

(15.) The depression mentioned in each instance is to be calculated from the present grade of the streets and avenues to be depressed, as such grades now appear on the grade maps of the city, unless otherwise stated.

(16.) All streets crossed by said railroad or which shall be changed, extended or laid out by the said party of the first part shall be properly graded and left in good condition for public use, and wherever a street or avenue whose grade or location shall be changed in pursuance of this agreement is now paved, flagged or curbed, the same shall be paved, flagged or curbed, as the case may be after changing the grade or location thereof in so far as the grade or location of any such street or avenue is changed; said work to be done by the said party of the first part.

(17.) All bridges to be constructed across the streets and avenues herein mentioned, shall be of iron, resting on stone abutments and iron columns, and shall in all cases span the entire width of each street or avenue to be crossed, except that the bridges across Broad Street and Morris Avenue shall be constructed as shown on the diagram hereto annexed; provided that iron columns may be erected on the curb lines of any street or avenue to support the bridges. All bridges shall be carefully decked and planked over, and so kept, in order to prevent anything from falling through into the streets.

(18.) Pennsylvania Railroad Avenue, twenty-five feet wide, extending from Broad Street to Magnolia Avenue to be vacated by the city, and all public interest therein for street purposes relinquished.

(19.) Walnut Street is now laid out to be extended across Chestnut Street in approximate continuation of its present lines to land now or formerly belonging to Crane, Tubbs & Co.; thence to be extended to East Broad Street, and at right angles thereto.

(20.) Fay Avenue to be continued northerly across DeHart Place, through the land of the party of the first part, lying on the northeasterly side of DeHart Place.

(21.) The land required for extending Walnut Street, and for the two new streets extending from West Jersey to Murray Street, and for the new street extending from Rahway Avenue to Cherry Street on the east side of the railroad to be laid out as stated above, shall be acquired for that purpose, and dedicated for street purposes by the said party of the first part; the city if necessary to use its power of condemnation to acquire the land; but all land so acquired shall be paid for by the said party of the first part.

(22.) All land required for making the changes in the location of Broad Street and Morris Avenue, as shown on the said diagram, now owned by the said party of the first part, shall be dedicated by the said party of the first part for street purposes. All land now included within the lines of Broad Street and Morris Avenue, and outside the proposed lines of said street and avenue, as the same appear on the said diagram, shall be vacated, and its use for street purposes relinquished, except so much thereof as is included by the lines of the proposed street or streets connecting Broad Street and Morris Avenue south of the building known as the "Tannery." All land required for making said connecting streets, now owned by said party of the first part, shall be dedicated for street purposes.

(23.) In all cases when any street or avenue has been or shall hereafter be laid out across the tracks of the railroad of the said party of the first part, and the city shall desire to open the same across the tracks, such desire to be expressed by a resolution of the City Council, a bridge shall be constructed either under or over the grade of such railroad; in which case the parties hereto shall each pay one-half of the expense of constructing the bridge required for such street.

(24.) Connections with the sewer system of the city, required to drain any street or avenue in consequence of the making of any of the changes or improvements herein mentioned, may and shall be made by the said party of the first part.

(25.) In all cases where the change of the grade or location of any street or avenue shall make it necessary to change the grade or location of any gas or water pipes or sewers, the same shall be changed by the said party of the first part, and left in a suitable condition for use.

(26.) Suitable retaining walls shall be constructed and maintained, wherever required, for the purpose of preventing any part of the embankment of said party of the first part from extending beyond the lines of its property.

(27.) The said party of the first part, shall erect in said city, a new and commodious passenger station of brick or stone, suitable for the proper accommodation of the people.

(28.) The material to be used for constructing embankments in the execution of this agreement shall be earth, brick or stone, and no garbage or other unhealthy or offensive substance or material shall be used.

(29.) Before beginning the work herein mentioned, accurate drawings showing the proposed elevation of the said railroad and the depression of each street and avenue shall be made in duplicate, and approved and verified by the signatures of the the City Surveyor of the said party of the second part, and the Chief Engineer, representing said party of the first part hereto. One copy of such drawings shall be held by each of the parties hereto, and the work shall be done according to such drawings.

(30.) The entire cost of elevating the tracks or railroad of the said party of the first part, and of making changes in the location and grades of the streets and avenues along the line of their railroad as herein provided, except Morris Avenue, shall be paid by the said party of the first part.

(31.) The opening, dedicating, grading and making ready for public use of the extension of Walnut Street and the two new streets extending from West Jersey Street to Murray Street, and the new street extending from Rahway Avenue to Cherry Street, and the Extension of Fay Avenue as herein provided shall be commenced within one month and completed within six months from and after the date hereof. The construction of such work preliminary to the work of elevating the tracks, as it is practicable to begin, shall be commenced on or before the first day of May next; and all the work required by this contract, including the elevation of tracks and the erection of a passenger station shall be fully completed within five years from the date hereof.

(32.) And it is hereby further agreed that upon the execution of this agreement the said party of the first part may complete the construction of four tracks through the said city, but the right to maintain and use more tracks across Broad Street or Morris Avenue than now exist, shall not continue beyond the time limited in this agreement for completing the work herein provided for, unless the said work shall be done in the manner herein required within such time.

(33.) The said city hereby assumes all legal liability, if any, for damages for changes of street grades and vacations of streets provided in this agreement.

(34.) And it is hereby distinctly admitted and declared by the parties hereto, that each of the terms, provisions and conditions of this contract is a necessary and proper part of the work and improvement herein provided for; that each party to this contract shall forthwith proceed to perform the acts and all of the acts herein required to be done by each party respectively, and shall complete the same as soon as practicable; and in case any party to this contract shall refuse, neglect or omit to do any act or take any proceeding herein required to be done or taken by such party, or necessary to be done in order to accomplish the object contemplated by this agreement, appropriate action may be taken by the other party hereto, to compel specific performance of any such act or proceeding, in addition to the right to enforce any legal claim for damages on account of such refusal, neglect or omission.

IN WITNESS WHEREOF, The said the United New Jersey Railroad and Canal Company, and the Pennsylvania Railroad Company, constituting the party of the first part hereto, have caused their corporate seals to be hereto affixed, these presents to be signed by their presidents, and attested by their secretaries, respectively; and the City of Elizabeth has caused its corporate seal to be hereto affixed, these presents to be signed by its mayor, and attested by its clerk, in triplicate, the day and year first above written.

THE UNITED NEW JERSEY RAILROAD AND CANAL CO.,
*Attest:* *by* R. S. STOCKTON, [L. S.]
LEROY H. ANDERSON, President.
Secretary of the
United N. J. Railroad
and Canal Company.

THE PENNSYLVANIA RAILROAD COMPANY,
*Attest:* *by* FRANK THOMSON, [L. S.]
J. C. SIMS, Vice-President.
Secretary of the
Pennsylvania R. R. Co.

THE CITY OF ELIZABETH,
*Attest:* *by* JNO. C. RANKIN, JR., [L. S.]
E. L. P. COLEMAN, Mayor.
Clerk of the
City of Elizabeth.

---

**This Agreement,** made this tenth day of December, eighteen hundred and ninety-one, between the UNITED NEW JERSEY RAILROAD AND CANAL COMPANY, and the PENNSYLVANIA RAILROAD COMPANY, its lessee, of the first part, and the CITY OF ELIZABETH, of the second part, *Witnesseth:*

That the Contract made by and between the parties hereto, and dated on the twenty-fourth day of December, eighteen hundred and ninety, providing for elevating the railroad tracks of the said party of the first part through the said city, and for other purposes, shall be and the same is hereby changed and modified as follows:

First. That arches of stone, or brick, instead of iron bridges, shall be constructed by said party of the first part over Magnolia Avenue and Chestnut, West Grand and West Jersey Streets in said city; each arch to have a clear span of at least fifty feet in width, measured at right angles to the centre line of each street respectively. Two arches of stone or brick, instead of an iron bridge shall also be constructed by said party of the first part over Broad Street, each with a clear span of forty-five feet, measured at right angles to the face of the abutments which shall be located as shown on the diagram hereto annexed. The spring of each arch to begin at least six feet above the sidewalks, and the bottom of the keystone of each arch shall not be more than six feet below the top of the rails of said railroad when the same shall have been elevated as provided in said contract. The said arches shall be located so that the keystones of each arch shall be directly over the centre line of said avenue and streets respectively, except on Broad Street; the curb lines shall not be changed. The arches over Broad Street shall be faced with stone, the other arches herein provided for shall be faced either with stone or pressed brick.

Second. Magnolia Avenue shall be depressed not more than five and eight-tenths feet below the rail of said railroad as now located, and to have a clearance of thirteen feet; grade of approach east side to be about level as far as Walnut Street, west side to ascend not more than three feet in a hundred. Chestnut Street to be depressed four and fourteen one-hundredths feet below the grade of the rails of said road as now located, and to have a clearance of thirteen feet, grade of approach on east side to descend from the railroad about one foot in a hundred, and on the west side, to ascend about three feet in a hundred. The grade of West Grand and West Jersey Streets shall not be depressed more than two feet; each street to have a clearance of thirteen feet. The grade of Broad Street shall not be depressed by the party of the first part more than one foot; but shall have a clearance of at least thirteen feet.

Third. The said arches shall be constructed at the expense of said party of the first part; and in such manner as to afford commodious under-grade crossings of the railroad of the said party of the first part. Nothing herein contained shall be construed to change or modify the said contract of December twenty-fourth, eighteen hundred and ninety, except as herein expressly stated.

IN WITNESS WHEREOF, The said the United New Jersey Railroad and Canal Company, and the Pennsylvania Railroad Company, constituting the party of the first part hereto, have caused their corporate seals to be hereto affixed, and these presents to be signed by their presidents and attested by their secretaries respectively; and the City of Elizabeth has caused its corporate seal to be hereto affixed, these presents to be signed by its mayor and attested by its clerk, in triplicate, the day and year first above written.

THE UNITED NEW JERSEY RAILROAD AND CANAL COMPANY,
*by* R. S. STOCKTON,
President.

*Attest:*
LEROY H. ANDERSON,
Secretary of the United New Jersey Railroad
and Canal Company.

THE PENNSYLVANIA RAILROAD COMPANY,
*by* FRANK THOMSON,
Vice-President.

*Attest:*
J. C. SIMS,
Secretary of the Pennsylvania Railroad
Company.

THE CITY OF ELIZABETH.
*by* JNO. C. RANKIN, JR.
Mayor.

*Attest:*
JAS. MANNING,
City Clerk of the City of Elizabeth.

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